HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Cowlitz River Spring Chinook (Segregated)
Species or Hatchery Stock:	Spring Chinook (*Oncorhynchus tshawytscha*) Cowlitz Hatchery Stock
Agency/Operator:	Washington Department of Fish and Wildlife Tacoma Power
Watershed and Region:	Cowlitz River/Lower Columbia
Date Submitted:	
Date Last Updated:	August 29, 2014

Executive Summary

The Washington Department of Fish and Wildlife is submitting a Hatchery and Genetic Management Plan (HGMP) for the Cowlitz River Spring Chinook program to the National Marine Fisheries (NMFS) for consultation under Section 10(a)(1)(A) or 4(d) of the Endangered Species Act (ESA). NMFS will use the information in this HGMP to evaluate the hatchery impacts on salmon and steelhead listed under the ESA. The primary goal of an HGMP is to devise biologically-based hatchery management strategies that ensure the conservation and recovery of salmon and steelhead populations. This HGMP focuses on the implementation of hatchery reform actions adopted by the Washington Fish and Wildlife Commission Policy on Hatchery and Fishery Reform C-3619.

The purpose of the program is to produce Cowlitz River spring Chinook for sustainable escapement to the watershed, while providing recreational harvest under mark-selective fisheries. Program fish will be produced at the Cowlitz Salmon Hatchery, located on the Cowlitz River (WRIA 26.0002). The program will annually release around 1,800,000 yearlings to the Cowlitz River. In addition, this program provides 355,000 green eggs to the Cathlamet Channel (see Cathlamet Channel Net Pen Spring Chinook HGMP) and approximately 55,000 yearlings for the Friends of the Cowlitz (FOC) net pen programs. The In-season Implementation Tool (ISIT) is used on an annual basis to monitor the program and compliance with Hatchery Scientific Review Group (HSRG) standards.

This spring Chinook HGMP is built around the principles and recommendations of the Hatchery Scientific Review Group (HSRG). These principles and recommendations represent the best science available for operating hatchery facilities consistent with the conservation of salmonid species. The program is operated as a "segregated type" program, as defined by the HSRG. A "segregated" program is one in which only hatchery-origin individuals are used in the hatchery broodstocks. Segregation is achieved by using returning adult hatchery-origin spring Chinook (distinguished by an adipose fin clip) returning to the Cowlitz River at the Cowlitz Salmon Hatchery trap from April through July. All fish released through this hatchery program have been 100% mass-marked (adipose fin-clipped) since 1996; of these, approximately 17% are also released coded-wire tagged (CWT).

The Lower Columbia River Chinook are listed as "Threatened" under the ESA. The ESU includes the Cowlitz Spring Chinook program in the upper Cowlitz River and the Cispus River.

Broodstock Collection:
The broodstock is derived from stock returning to the Cowlitz sub-basin. The current egg-take goal is around 2.8-million at Cowlitz Salmon Hatchery; approximately 1,550 adult pairs may be collected. Currently, all available adults above hatchery need are transferred for release to the upper Cowlitz. Under the updated FHMP (2011), No restrictions on placing hatchery fish upstream will occur until a trigger of 60% fish passage survival is achieved with current survival under 20%.

Harvest:
Total annual harvest is dependent on management response to annual abundance in *Pacific Salmon Commission* (PSC - U.S./Canada), *Pacific Fishery Management Council* (PFMC - U.S. ocean), and *Columbia River Compact* forums. WDFW has also received authorization for tributary, Columbia River mainstem, and ocean fisheries; the combined harvest rates in the *Fisheries Management and Evaluation Plan* (FMEP), *Columbia River Fish Management Plan* (CRFMP), and ocean fisheries are reviewed annually in the North of Falcon process to ensure the harvest rates are consistent with recovery of the Lower Columbia River Tule Chinook population. The *U.S. v Oregon* Technical Advisory Committee (TAC) has prepared Biological Assessments (BAs) for combined fisheries based on relevant *U.S. v Oregon* management plans and agreements. The current BA concerns Columbia River treaty Indian and non-Indian fisheries, as described in the "2008–2017 *U.S. v Oregon* Management Agreement for upriver Chinook, sockeye, steelhead, coho, and white sturgeon" (2008–2017 MA).

Under permanent regulations, the mainstem Columbia River from Buoy 10 to the I-5 Bridge (RM 106) is open for spring Chinook angling during January 1 through March 31, and the area from the I-5 Bridge

upstream to the Oregon/Washington border (upstream of McNary Dam) has been closed beginning January 1 each year since 1993. Mark-selective recreational fisheries for spring Chinook have occurred annually since 2001. These fisheries were generally characterized by high effort and catch rates, as well as excellent compliance among anglers with the mark-selective fishing regulations.

Due to limitations that not all fish can be accounted for as being harvested or as back-to-rack counts, smolt-to-adult survival rates (SAR) are likely underestimated. Based on the average SAR of 0.94% for brood years 2000-2009, and a programmed release goal of approximately 1,800,000 yearlings, the estimated production goal would be approximately 17,000 adults.

Monitoring and Evaluation:
Performance indicators for harvest will be accomplished by continuing mass-marking (adipose fin-clip); CWT recoveries help determine stray rate contributions on spawning grounds by watersheds close in proximity to this program's release vicinity.

Operation and Maintenance of Hatchery Facilities:
WDFW's Cowlitz spring Chinook program are produced at Cowlitz Salmon Hatchery, which draws water from multiple sources: wells with a water right of 4,920 gpm; and an intake on the Cowlitz River with a water right of 200 cfs. Intake and screen criteria are in compliance with state and federal guidelines (NOAA-NMFS 1995, 1996), but do not meet the current Anadromous Salmonid Passage Facility Design criteria (NOAA-NMFS 2011). Tacoma Power is investigating the intake to see if reasonable measures could result in improvements. The Cowlitz Salmon Hatchery operates under the *"Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System* (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE).

The FOC program at Toledo Sand and Gravel Pond #5 is fed by spring-water and Cowlitz River surface water, which seeps into the pond at an unknown rate. The Toledo Sand and Gravel Pond #5 is segregated from the Cowlitz River; by a large net structure, there is no access to the pond by other fish. The facility operates within the limitations established in its National Pollution Discharge Elimination System (NPDES) permit and the production from this facility falls below the minimum production requirement for an NPDES permit.

1 SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1 Name of hatchery or program.

Cowlitz River Spring Chinook

1.2 Species and population (or stock) under propagation, and ESA status.

Cowlitz Spring Chinook (*Oncorhynchus tshawytscha*)

ESA Status: "Threatened" March 24, 1999 (64FR14308); reaffirmed on June 28, 2005 (70FR37160); reaffirmed August 15, 2011 (76 FR 50448).

1.3 Responsible organization and individuals

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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Tacoma Power - Funding Source and Cowlitz Salmon Hatchery Facility Owner

Friends of the Cowlitz (FOC): Non-profit rearing and salmon recovery organization provides staff and support and in-kind services

1.4 Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources	Operation Information
Tacoma Power	Full time equivalent staff – 12.7 Annual operating cost (dollars) - $2,656,072

Note: Specific costs apply to all species produced at this facility.

1.5 Location(s) of hatchery and associated facilities.

Broodstock Source: Cowlitz River Spring Chinook stock

Table 1.5.1: Location of culturing phases, by facility.

Facility	Culturing Phase	Location
Cowlitz Salmon Hatchery	Broodstock collection, adult holding/spawning, incubation, rearing, acclimation.	Located on the Cowlitz River (WRIA 26.0002) at RKm 79.0, tributary to the Columbia River at RKm 109.4 Lower Columbia River, Washington.
FOC Toledo Sand and Gravel Pond Net Pens	Acclimation	Located on the Cowlitz River (WRIA 26.0002) at RKm 44.5; tributary to the Columbia River at RKm 109.4; Lower Columbia River, Washington.

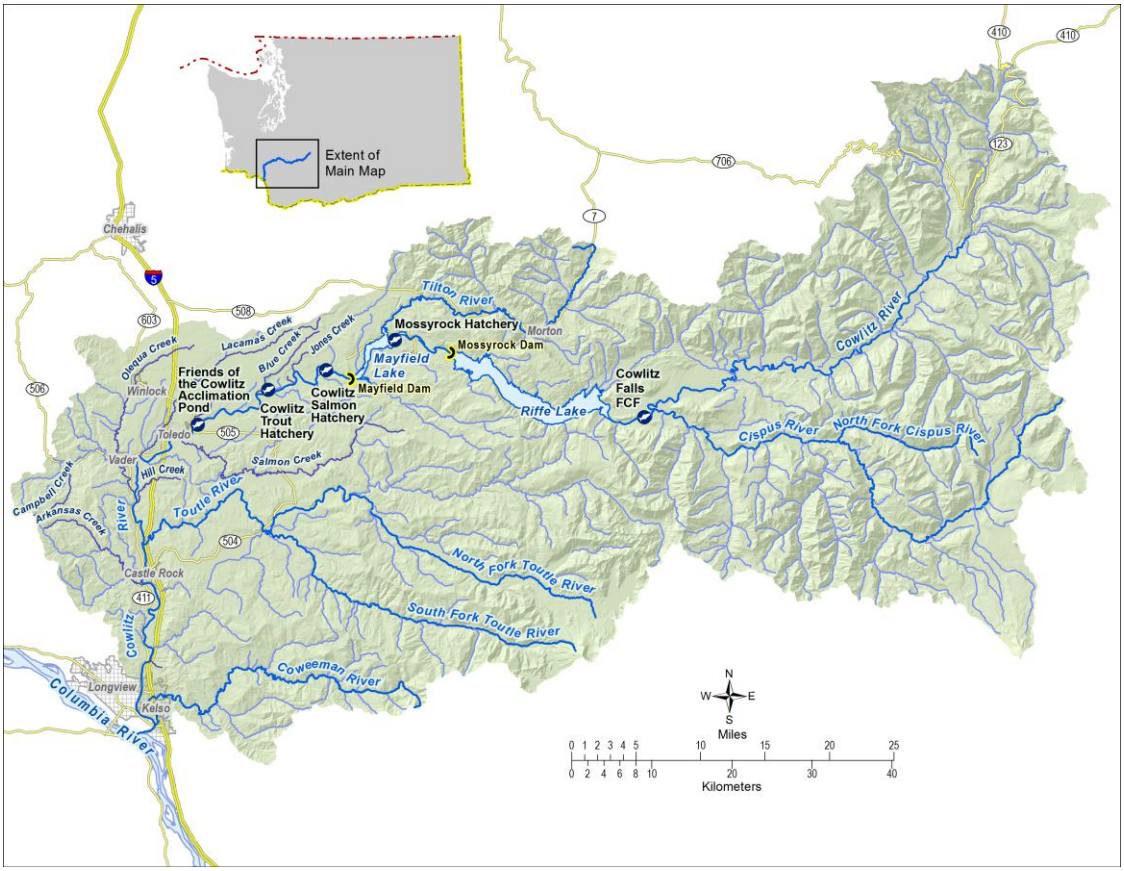


Figure 1.5.1: Map of Cowlitz Salmon and Trout Hatchery Facilities and Cowlitz Falls Fish Collection Facility. Source: WDFW GIS 2014.

1.6 Type of program.

Segregated Harvest. Transition to integrated program over time per the FHMP (November 2011).

1.7 Purpose (Goal) of program.

Mitigation/Augmentation. The purpose of this program is to: 1) contribute to commercial and sport harvest in the lower Cowlitz River and Lower Columbia River/Estuary; 2) re-establish and conserve naturally-producing populations of spring Chinook into the upper Cowlitz River and tributaries; and 3) contribute to research and education through mitigation for development (including hydro-power) and habitat degradation. The new Cowlitz River Hydroelectric Project Settlement Agreement (SA) has prioritized restoring ecosystem integrity with the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels (The Cowlitz River Project, Federal Energy Regulatory Commission (FERC) No. 2016, August 2000). In order to achieve these goals, the endemic hatchery stocks will serve as gene banks for native Cowlitz basin stocks of fish and be used to rebuild and restore wild stocks and provide continued harvest opportunities. The harvest goal for this program is 10,000 to 20,000 fish in the lower Cowlitz per the *Fisheries and Hatchery Management Plan* (FHMP update 2011).

In addition, this program provides eggs for the Cathlamet Channel net pen program, (see **Cathlamet Channel Spring Chinook HGMP**). In 2011, 2012 & 2013, eyed eggs have also been provided to the Upper Cowlitz Restoration program. The juvenile transfers were discontinued and eggs taken above hatchery program needs were transferred to Biologists for artificial redd distribution in tributaries to the Cowlitz in the upper watershed above Cowlitz Falls Dam. These

eggs were a result of a disproportionate number of female to male ratio from the early-run brood collection season.

1.8 Justification for the program.

The program is funded through the Tacoma Power for the purpose of mitigation for lost fish production due to hydro-power development within the Cowlitz River basin. WDFW protects listed fish and provides harvest opportunity on hatchery fish through the lower Columbia River *Fish Management and Evaluation Plan* (FMEP, WDFW 2001) and the Cowlitz River *Fisheries and Hatchery Management Plan* (FHMP, update 2011).

Chinook were historically abundant in the sub-basin. The construction of Mayfield and Mossyrock Dams blocked access to much of the historical spawning habitat (Myers et al. 2003). By the late 1990s, most indigenous anadromous populations in the Lower Columbia ESU, including the Cowlitz River system, were either depressed, proposed for, candidate species or listed under the Endangered Species Act (ESA). The new Cowlitz River Hydroelectric Project Settlement Agreement (SA) has prioritized restoring ecosystem integrity with the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels (The Cowlitz River Project, FERC No. 2016, August 2000). The Cowlitz River Fisheries and Hatchery Management Plan (FHMP, update 2011) proposes hatchery operations which will rear salmonids native to the Cowlitz River as integrated programs, and all non-native species as segregated programs. The lower Cowlitz spring Chinook program is currently run as a segregated program with a long term goal of switching to an integrated program once reintroduction takes hold in the upper basin. There are no natural production goals for lower Cowlitz spring Chinook. However, because the original broodstock source for this program was the native spring Chinook from the upper Cowlitz basin, the program also serves as a temporary gene bank for the planned reintroduction of spring Chinook into the upper Cowlitz/Cispus and Tilton basins (FHMP, update 2011). Available spring Chinook adults above hatchery needs have been reintroduced into the upper Cowlitz basin since 1996.

Friends of the Cowlitz (FOC) is a 501(c)-3 non-profit citizen organization that began in 1988. FOC works closely with the WDFW, Lewis County PUD and BPA to restore the runs of anadromous fish (salmon, steelhead and cutthroat trout) in the Cowlitz River and its tributaries. FOC is also involved in net pen rearing projects in the lower Cowlitz River for spring Chinook.

Fish transfers to the FOC Toledo Sand and Gravel net pen site are a portion of the total production from the main Cowlitz Salmon Hatchery (CSH) operations based on the *Fisheries and Hatchery Management Plan* (FHMP, update 2011). The CSH program is funded through the Tacoma Power for the purpose of mitigation for lost fish production due to development within the Cowlitz River Basin. WDFW protects listed fish and provides harvest opportunity on hatchery fish through the lower Columbia River *Fish Management and Evaluation Plan* (FMEP, WDFW 2001) and the Cowlitz River FHMP.

The primary focus of anadromous salmonid fisheries in the lower Columbia River are to provide targeted harvest of known hatchery-origin steelhead, and spring and fall Chinook, coho, and sea-run cutthroat salmon. The FOC spring Chinook releases from the lower Cowlitz River are designed to spread out the harvest opportunities in the lower Cowlitz River. The river adjacent to Toledo Sand and Gravel net pens is a popular drift with fishing guides.

To minimize impact on listed fish by the Cowlitz River spring Chinook program and operations, the following risk aversions are included in this HGMP **(Table 1.8.1).**

Table 1.8.1: Summary of risk aversion measures for the Cowlitz River spring Chinook program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Water rights for the Cowlitz Salmon Hatchery are formalized through trust water rights from the Department of Ecology. Monitoring and measurement of water usage is

		reported in monthly NPDES reports.
Intake Screening	4.2	Intake and screen criteria are in compliance with state and federal guidelines (NOAA-NMFS 1995, 1996), but do not meet the current *Anadromous Salmonid Passage Facility Design* criteria (NOAA-NMFS 2011). The intake was evaluated by a WDFW engineer in November 2004.
Effluent Discharge	4.2	This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) administered by the Washington Department of Ecology (DOE) WAG 13-1021.
Broodstock Collection & Adult Passage	7.9	Facility follows WDFW broodstock collection and sorting protocols; any non-target listed fish can be quickly identified and, if encountered, are released back to the stream to minimize impacts.
Disease Transmission	7.9, 10.11	The *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006) and the *Fish Health Policy in the Columbia Basin* details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Health Policy Chapter 5, IHOT 1995).
Competition & Predation	2.2.3, 10.11	Fish are released at a time, size and the system and life history stage to foster rapid migration to marine waters, and to allow juvenile listed fish to grow to a size that reduces potential for predation. Current risk aversions and future considerations are being reviewed and evaluated for further minimizing impacts to listed fish.

1.9 List of program "Performance Standards".

See HGMP section 1.10. Performance Standards below pertain to the hatchery production at Cowlitz Salmon Hatchery only and do not contain complete indicators for the upriver reintroduction program. For further information on upriver performance indicators and standards, refer to the Final Draft FHMP (update 2011).

1.10 List of program "Performance Indicators", designated by "benefits" and "risks."

1.10.1 "Performance Indicators" addressing benefits.

Table 1.10.1.1: "Performance Indicators" addressing benefits.

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.2 Program contributes to mitigation requirements. Program provides mitigation for lost fish production due to development within the Columbia River Basin and contributes to sport and commercial fisheries (Columbia River Fish Management Plan, *U.S. v Oregon*).	Number of fish released by program returning, or caught, as applicable to given mitigation requirements.	Annually estimate survival and contribution to fisheries for each brood year released. Production releases are consistent with the Cowlitz Fisheris Technical Committee (FTC) and FHMP goals. This program provides mitigation for lost fish production due to development within the Cowlitz system; contributes to estuary sport and

		commercial, and lower Cowlitz river sport fisheries, and supports Upper Cowlitz basin restoration and recovery.
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP updated and re-submitted to NOAA with significant changes or under permit agreement. Enhancement co-op submits yearly WDFW Volunteer Fish Production Release and Planting Record Form that includes details on number of fish, date and location of releases..
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding overharvest of non-target species.	Annual number of fish produced by program caught in all fisheries, including estimates of fish released.	Annually mass-mark hatchery releases to differentiate hatchery from natural-origin fish and record estimates of mark rate. The external mark enables mark-selective fisheries, which can reduce directed harvest mortality on natural-origin fish. Agencies monitor harvests and hatchery returns to provide up-to-date information. Estimate survival and contribution to fisheries for each brood year released.
3.3.1. Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.	Annual number of naturally-produced adults or redds on the spawning grounds or selected natural production index areas.	Annually monitor and report returns to the hatchery and spawning grounds. Enhancement co-ops submit an MOU to WDFW for each year involved in the project.
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.	Number of marks released and estimated proportion of marks in out-migrant juveniles and returning adults. Percentage of total hatchery releases mass-marked (fin clips, otoliths, tags, etc., depending on species) to allow for their differentiation from naturally-produced fish as returning adults.	Annually monitor and report size, number, date of release and mass-mark quality (adipose fin-clip rate) of all on-station hatchery releases. Annually sample returning fish for the adipose fin-clip in fisheries and at the hatchery; record numbers of estimated hatchery (marked) and natural (unmarked) fish. This program was modelled to meet HSRG standards for pHOS using the ISIT tool once collection efficiencies meet SA standards. Program is reviewed annually.
3.4.1 Fish collected for broodstock are taken throughout	Temporal distribution of broodstock collection at point of	Collect broodstock representatively and

the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	collection.	systematically throughout the return (April through July). Collect annual run timing, age and sex composition and spawning escapement timing data. Adhere to WDFW spawning guidelines (Seidel 1983; HSRG 2009).
3.5.5 Juveniles are released at fully-smolted stage to benefit juvenile to adult survival rates, and reduce the likelihood for residualism and negative ecological interactions with natural-origin fish.	Smoltification status and behavior are monitored in the hatchery.	Monitor fish condition in the hatchery throughout all rearing stages. Annually monitor and record size, number, and date of release.
3.6.1 The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Apply minimal monitoring standards in the hatchery: food conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV).	Collect annual run timing, age and sex composition data upon adult return. Annually record growth rates, mark rate and size at release and release dates. Adhere to HSRG (2009) and WDFW spawning guidelines (Seidel 1983). Enhancement co-ops submit yearly WDFW Volunteer Fish Production Release and Planting Record Form, which includes details on number of fish, date and location of releases. See also HGMP section 11 for program monitoring and evaluation.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Program is designed to help achieve the end goal of conserving and stabilizing natural salmon populations.	Long-term monitoring of system population will indicate success of program.
	Provide information about agency programs and hatchery operations to such internal and external audiences as local schools and special interest groups. Off station efforts may include festivals, classroom participation, stream adoptions and fairs.	Record on-station organized education and outreach events. Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program.
	Partnerships and education with local government and citizens. Volunteer groups coordinate on-going and future co-operative enhancement projects.	WDFW and the enhancement co-op annually tracks and reports volunteer involvement and total hours committed.

1.10.2 "Performance Indicators" addressing risks.

Table 1.10.2.1: "Performance indicators" addressing risks.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.3 Program addresses ESA responsibilities	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP is updated to reflect any major changes in program and resubmitted to NOAA fisheries. Program risks have been addressed in this HGMP through best available science hatchery management actions. WDFW staff annually reviews Future Brood Document (FBD) for stock, size, number, date and location of releases from all production programs. Monitor and record juvenile hatchery fish size, number, date of release and mass-mark quality; monitor contribution of hatchery adult fish to fisheries and escapement.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while adequately minimizing by-catch of non-target species.	The number of marks released and the proportion of marks in out-migrant juveniles and returning adults on the spawning ground are estimated annually. Production fish are mass-marked (adipose fin-clip) to allow for their differentiation from naturally-produced fish	Monitor and record juvenile hatchery fish size, number, date of release and mass-mark quality; monitor contribution of hatchery adult fish to fisheries and escapement. Harvest is regulated to meet appropriate biological assessment criteria. Spring Chinook fisheries in the Cowlitz River are mark selective, and require the release of all wild coho. Agencies monitor harvests and hatchery escapements to provide up-to-date information.
3.2.2 Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	Percentage of total hatchery releases are identifiable as hatchery-origin fish. Mass-mark (adipose-fin clip, CWT, otolith-mark, etc., depending on species) produced fish to allow for their differentiation from naturally produced fish for selective fisheries.	Annually monitor and report mass-mark type, quality and rates. Assess annual harvest of mass-marked hatchery fish based on CWT recovery estimates and creel surveys (see HGMP section 3.3.1).
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production and to evaluate effects of the program on the	All hatchery production is identifiable in some manner (fin-marks, tags, otolith, etc.) consistent with information needs.	Annually monitor and record size, number, date of release and mass-mark quality (adipose fin-clip rate) of on-station hatchery releases. Examine returning fish

local natural population.		encountered for the mass-mark (CWT) at the hatchery and on the spawning ground. Annually record numbers of estimated hatchery (marked) and natural (unmarked).
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	Temporal and age distribution of broodstock collected, compared to that of naturally-produced population at collection point.	Collect annual run timing, age and sex composition and return timing data.
3.4.2 Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.	Number of spawners of natural-origin removed for broodstock.	Trap is checked daily. Non-target listed fish, when encountered, are returned to the river.
3.5.1 Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	Within and between populations, genetic structure is not affected by artificial production.	See HGMP section 11 for M&E information.
3.5.2 Collection of broodstock does not adversely impact the genetic diversity of the naturally-spawning population.	Total number of natural-origin spawners (if any) reaching the collection facility. Timing of collection compared to overall run timing.	All hatchery production is identifiable in some manner (fin-marks, tags, etc.). Collect annual run timing, origin, and age and sex composition data. Examine returning fish for the mass-mark (adipose fin-clip) at broodstock collection points and on the spawning grounds. Annually record and report numbers of estimated hatchery (marked) and natural (unmarked).
3.5.4 Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Location of release (on-station, acclimation pond, direct plant). Release type (forced, volitional or direct stream release).	Annually record and report release information, including location, method and age class in hatchery data systems (WDFW Hatcheries Headquarters Database).
3.5.5 Juveniles are released at fully-smolted stage.	Level of smoltification at release. Release type (forced, volitional or direct).	Annually monitor and record size, number, date of release and release type.
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (IHOT, PNFHPC, *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State*).	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level of compliance with applicable standards and criteria.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed. The program is operated consistent with the *Salmonid Disease Control Policy of the*

		Fisheries Co-Managers of Washington State (WDFW and WWTIT 1998, updated 2006). Enhancement co-op coordinators communicate regularly with Region 5 staff.
3.7.2 Effluent from hatchery facility will not detrimentally affect natural populations.	Discharge water quality compared to applicable water quality standards by NPDES permit. Washington Department of Ecology (WDOE) water right permit compliance.	Flow and discharge reported in monthly NPDES reports. Enhancement co-ops comply with all permits required and must submit an MOU to WDFW for each year involved in the project before project is approved.
3.7.3 Water withdrawals and in-stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Water withdrawals compared to NMFS, USFWS and WDFW applicable passage and screening criteria for juveniles and adults.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
3.7.4 Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens. Follow the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, revised 2006).	Necropsies of fish to assess health, nutritional status, and culture conditions.	WDFW Fish Health Section inspects adult broodstock yearly for pathogens and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings. Enhancement co-op leads and coordinators communicate regularly with Region 5 staff.
	Release and/or transfer exams for pathogens and parasites.	Examine fish 1 to 6 weeks prior to transfer or release, in accordance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
	Inspection of adult broodstock for pathogens and parasites.	At spawning, all females are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and	Controls of specific fish pathogens through eggs/fish movements are conducted in

	parasites.	accordance to the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
3.7.6 Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally-produced population.	Spatial and temporal spawning distribution of natural populations above and below broodstock collection site is currently compared to historic distribution.	Trap is checked daily. Non-target and/or ESA-listed fish, when encountered, are returned to the river.
3.7.7 Weir/trapping operations do not result in significant stress, injury or mortality in natural populations.	Mortality rates in trap. Pre-spawning mortality rates of captured fish in the hatchery and/or after release.	Traps checked daily. Annually record and report abundances and observations of natural-origin fish at hatchery facilities.
3.7.8 Predation by artificially produced fish on naturally – produced fish does not significantly reduce numbers of natural fish.	Hatchery juveniles are raised to smolt-size and released from the hatchery at a time that fosters rapid migration downstream.	Hatchery smolt release size and time are monitored to quantify/minimize predation effects on naturally produced Chinook (Sharpe et al. 2008, Topping and Zimmerman 2011).
3.8.2. Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	Total cost of program operation.	Annually monitor and report feed costs and fish health actions.

1.11 Expected size of program.

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

Approximately 1,337 adults and approximately 30 jacks are needed to meet on-station program goals.

An additional 200 adults are needed to provide broodstock to support the 355,000 green eggs provided for the Cathlamet Channel net pen program (see also **Cathlamet Channel spring Chinook HGMPs**). In addition, this take provides 55,000 yearlings to the Friends of the Cowlitz (FOC) net pen program. Net pen programs are included in the total egg-take which is around 2.8-million.

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

Table 1.11.2.1: Proposed annual fish release levels (maximum number) by life stage and location.

Age Class	Max. No.	Size (fpp)	Release Date	Location	Major Watershed
Yearlings	500,000	16.0	November	Lower Cowlitz	Cowlitz
	496,899[a]	5.0	March/April	Lower Cowlitz	Cowlitz
	800,000	8.0	March/April	Lower Cowlitz	Cowlitz

Source: Future Brood Document 2014.

[a] Includes 55,000 yearlings provided to the Friends of the Cowlitz Toledo Net Pens project; does not include Cathlamet Channel net pens).

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

There are no natural production goals for lower Cowlitz spring Chinook (this is a segregated program). However, because the original broodstock source for this program was the native spring Chinook from the upper Cowlitz basin, the program also serves as a temporary gene bank for the planned reintroduction of spring Chinook into the upper Cowlitz/Cispus and Tilton basins (FHMP, update 2011). Available spring Chinook adults above hatchery needs have been reintroduced into the upper Cowlitz basin since 1996. The Toledo Sand and Gravel spring Chinook releases constitute approximately 3% of the total production released to the lower Cowlitz River.

Table 1.12.1: Returns of Spring Chinook to the Cowlitz Salmon and Trout Hatchery 2002-2013.

Return Year	Hatchery Return	Hatchery- Origin Fish Released Upstream	Natural- Origin Fish Released Upstream
2002	4,544	1,763	26
2003	12,558	8,589	559
2004	15,786	11,471	261
2005	8,623	6,506	146
2006	6,261	3,135	72
2007	5,327	1,924	79
2008	3,052	820	81
2009	7,013	2,457	94
2010	7,624	8,281	250
2011	4,371	2,212	112
2012	6,808	4,530	276
2013	7,951	2,577	320
Average	**7,493**	**4,522**	**190**

Source: Hatcheries Headquarters Database 2014.

For SAR calculation see **Table 3.3.1.1.**

1.13 Date program started (years in operation), or is expected to start.

Spring Chinook salmon have been reared at the Cowlitz Salmon Hatchery since 1967.

1.14 Expected duration of program.

Spring Chinook production from CSH is part of the continued operation of the Cowlitz River Hydroelectric Project, FERC Project No. 2016, which operates under the new license with an effective date of July 18, 2003. The license is for a term of 35 years and expires July 18, 2038.

The Friends of the Cowlitz enhancement cooperative began rearing spring Chinook in fall 1991 (in 1992 releases). From 1991-1995, additional cooperative enhancement programs have released spring Chinook from net pen sites near Castle Rock and Toledo (see **HGMP section 10.3**), however, as of 2012, only the Toledo Sand and Gravel net pen site has produced spring Chinook.

1.15 Watersheds targeted by program.

Cowlitz River (WRIA 26.0002)/Lower Columbia

1.16 Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

1.16.1 Brief Overview of Key Issues.

Note: Issues stated below have been addressed in the new FERC Settlement Agreement (The Cowlitz River Project, FERC No. 2016, August 2000, and the FERC EIS 2001 and NMFS BiOp 2004).

Issue 1: Hatchery spring Chinook were reared at a hatchery operating out of the Clear Fork ofthe Cowlitz River until 1950 when that hatchery ceased operation. The construction of Mayfield Dam in 1963 and Mossyrock Dam in 1967 eliminated access to the entire historical spawning habitat for spring Chinook salmon in the Cowlitz River. The Cowlitz Salmon Hatchery was completed in 1967, with a mitigation goal of 17,300 adult spring Chinook salmon. Volitional access to natural spawning is now limited to a 12.8 km (7.7 miles) stretch in the mainstem Cowlitz River below the hatchery. Historically there were three demographically independent populations in the Tilton, Cispus, and upper Cowlitz River basins. These populations were homogenized into a single hatchery stock, which is currently released into the lower Cowlitz River. Although the hatchery program has not achieved its mitigation goal, that hatchery has been able to maintain production using locally returning adults. After an eleven year hiatus adult spring Chinook salmon from the Cowlitz Salmon Hatchery were released above Cowlitz Falls Dam in 1999 (See **1.16.1**). The biological resources of the three extirpated upper Cowlitz stocks are present, albiet in a homogenized form, in the Cowlitz River Salmon Hatchery broodstocks. However, it is not known to what extent genetic variability has been lost or adaptive genetic complexes disrupted. The hatchery stock represents one of the few remaining spring Chinook salmon populations in the Lower Columbia River (LCR) Chinook salmon Evolutionary Significant Unit (ESU), and is considered vital to the recovery effort in the LCR basin. The Cowlitz SA has been agreed upon by the parties to prioritize the continued operation of the hatcheries for the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels. Overall plans for future restoration and recovery of the spring Chinook program exists in the FHMP (Section 5.2).

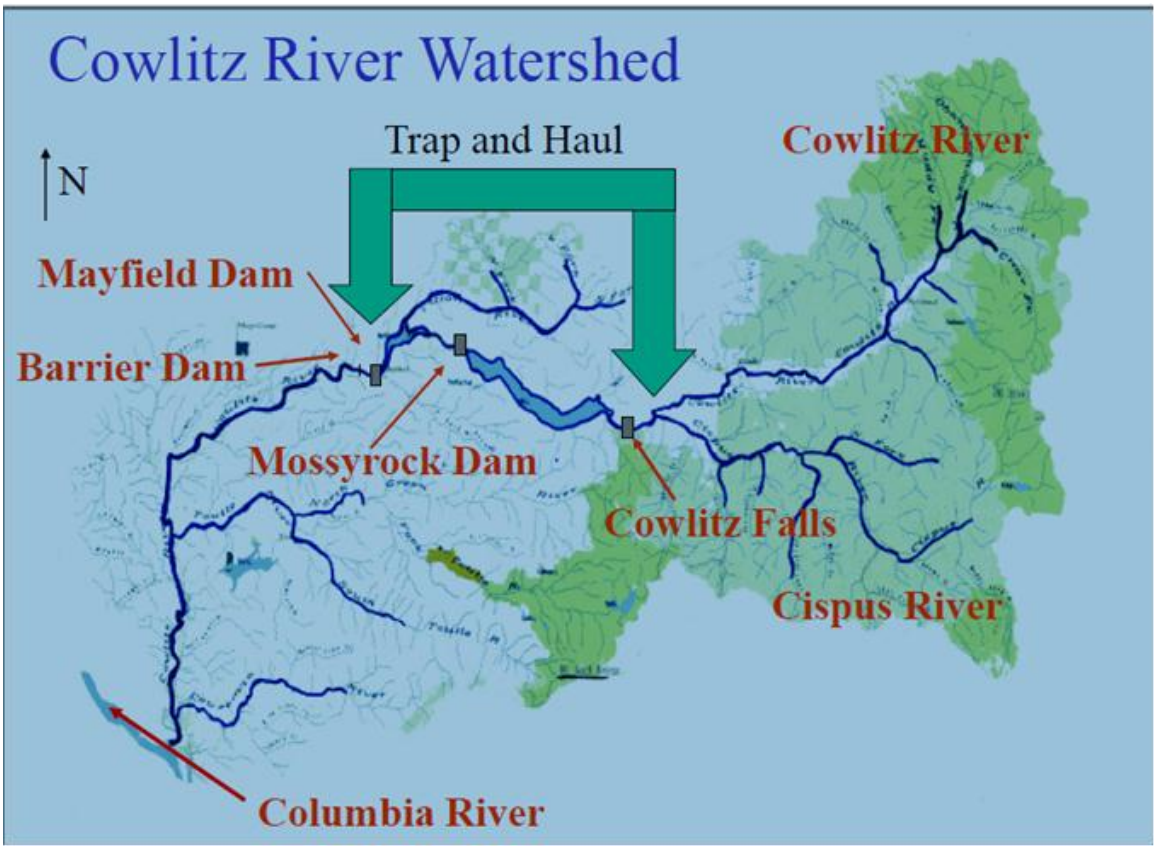


Figure 1.16.1: Map of adult trap and haul sites for reintroduction in the Upper Columbia River watershed. Source: WDFW 2014.

Issue 2: Since the mid-1990s, significant restoration activities in the upper basin have taken place including adult re-introduction, fry and fingerling releases and subsequent natural smolt productivity. The greatest obstacle to restoration of upper basin anadromous fish runs is downstream passage of juvenile salmonids (smolts). They must be captured or collected to ensure that they do not residualize in

a reservoir or incur significant mortality through a turbine. The Cowlitz Falls Dam (operated by the Lewis County Public Utility District) is the center of efforts to collect downstream migrant salmonids and transport them safely around hazards of reservoirs and dams to the lower river. Juvenile salmonids produced in the Tilton River pass downstream through the Mayfield Counting House or turbines at Mayfield Dam.

The Friends of the Cowlitz (FOC) has been involved in habitat and rearing programs with WDFW and Tacoma Power for almost two decades. Levels of future productivity from the lower river are outlined in the FHMP (update 2011). Issues in the FHMP are mostly agreed upon and form the basis of future hatchery production in the basin is dependent upon annual monitoring and evaluations and an adaptive management program.

1.16.2 Potential Alternatives to the Current Program

Note: Although instructions in the Potential Alternatives HGMP section indicate draft plans not necessarily endorsed by management, the following alternatives have been agreed upon and supported by parties to the SA.

Alternative 1: Significant remodel plans within the Cowlitz Complex facilities are described in Article 7 that will be of significant benefit to producing Chinook for continued support of upper river efforts[1]. These include: a) hatchery design drawing that includes decreased rearing densities and innovative practices to replicate historic out-migration size and timing; b) plans for construction scheduling; c) provision for hatchery water supply that maximizes water from existing groundwater wells and, if necessary, provides for treatment of up to 10 cfs additional river water; and d) a plan for gradual transition to innovative rearing practices. Both, current and future lower and upper river production are proposed by the FHMP. The FHMP indicates that as natural production increases, hatchery production would decrease based on credit mechanisms (see section 3.7 FHMP) after the hatchery re-build (>2010). Though the Project has inundated miles of river and tributaries, natural production may not totally be able return to pre-project levels. WDFW is committed to improving hatchery production and making it consistent with wild fish restoration in the Cowlitz basin, but modification of hatchery practices or reductions in lower river production must be evaluated.

Alternative 2: Significant habitat improvements for upstream and downstream have been agreed to in the SA including: Article 1. Downstream Fish Passage: Riffe Lake and Cowlitz Falls Collection and Passage, Article 2. Downstream Fish Passage: Mayfield and Article 3. Upstream Fish Passage: Barrier, Mayfield and Mossyrock. In the meantime, existing hauling of adults and trucking of smolts will continue. A number of issues hinge on the success of fish passage improvements including the full potential of the upper basin production.

1.16.3 Potential Reforms and Investments

Although costly, the development of restoration programs for the Cowlitz River watershed upstream of the Barrier Dam represents a balancing act between competing needs for harvest and stock restoration, the evolving improvement of fish collection and passage for downstream migrants, the restoration of ecological function in the watershed, and host of other inputs currently unknown. The plan used to guide the process will need to be flexible enough to adapt to new information, aggressive enough to achieve success, and well-enough evaluated to guide this and future projects of this type.

The Cowlitz Salmon Hatchery rebuild was completed in 2010. Planning, developing and reviewing alternatives for Cowlitz River fisheries management is currently underway through the Cowlitz Fisheries Technical Committee. The committee is comprised of representatives from WDFW, NOAA fisheries, Tacoma Power, Trout Unlimited, Washington Department of Ecology, US Fish and Wildlife Service, and the Yakama Indian Nation.

2 SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1 List all ESA permits or authorizations in hand for the hatchery program.

None currently. This HGMP is submitted to the NOAA Fisheries for ESA consultation and take prohibition exemption under ESA section 4(d) or 10.

2.2 Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1 Description of NMFS ESA-listed salmonid population(s) affected by the program.

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program.

Lower Columbia River Chinook (*Oncorhynchus tshawytscha*). Listed as "threatened" on March 24, 1999 (64FR14308); threatened status reaffirmed on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.

Lower Columbia River steelhead (*Oncorhynchus mykiss*). Listed as a threatened species on March 19, 1998 (63FR13347); threatened status reaffirmed on January 5, 2006 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Lower Columbia River coho (*Oncorhynchus kisutch*). Identified as a candidate species on June 25, 1995 (60FR38011). Listed as threatened on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Columbia River chum salmon (*Oncorhynchus keta*). Listed as threatened on March 25, 1999 (64FR14507); threatened status reaffirmed on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

2.2.2 Status of NMFS ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

Lower Columbia River Chinook: In Washington, the LCR Chinook ESU includes all naturally spawned Chinook populations from the mouth of the Columbia to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, as well as seventeen artificial propagation programs (NMFS 2005 -70FR37160). Spring Chinook were present historically in the Cowlitz, Kalama, Hood, White Salmon and Lewis rivers.

Status: Today only two of 32 historical populations – the North Fork Lewis and Sandy late-fall populations – are considered viable. Most populations (26 out of 32) have a very low probability of persistence over the next 100 years, and some populations are extirpated, or nearly so. Five of the six strata fall significantly short of the Willamette- Lower Columbia Technical Recovery Team (WLC TRT) criteria for viability. One stratum – Cascade late fall – meets the WLC TRT criteria (Dornbush and Sihler 2013). Dam construction eliminated habitat for a number of populations leading to the extirpation of spring Chinook salmon populations in the Upper Cowlitz, Cispus, Tilton, North Fork Lewis , Big White Salmon rivers, and fall Chinook populations in the Upper Cowlitz and Big White Salmon rivers (SHIEER, NMFS 2004). Projects to allow access have been initiated in the Cowlitz and Lewis systems but these are not close to producing self-sustaining populations; Condit Dam on the Big White Salmon River was breached October 26, 2011. Based on the 2010 recovery plan analyses, all of the 14 Tule populations

(**Table 2.2.2.1**) are considered very high risk except one that is considered at high risk. The modeling conducted in association with Tule harvest management suggests that three of the populations (Coweeman, Lewis and Washougal) are at a somewhat lower risk (LCFRB 2010).

Table 2.2.2.1: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River Chinook populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast Fall										
Grays/Chinook	Contributing[2]	VL	H	VL	VL[2]	M+	+500%	800	<50	1,000
Eloch/Skam [C]	Primary	VL	H	L	VL[2]	H	+150%	3,000	<50	1,500
Mill/Aber/Germ	Primary[1]	VL	H	L	VL[2]	H	+155%	2,500	50	900
Youngs Bay (OR)	Stabilizing	--[3]	--[3]	--[3]	L	L	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [C]	Contributing[1]	--[3]	--[3]	--[3]	VL	L	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary[1]	--[3]	--[3]	--[3]	L	H	--[3]	--[3]	--[3]	--[3]
Cascade Fall										
Lower Cowlitz [C]	Contributing	VL	H	M	VL[2]	M+	+50%	24,000	500	3,000
Upper Cowlitz	Stabilizing	VL	VL	M	VL	VL	--	28,000	0	--
Toutle[C]	Primary[1]	VL	H	M	VL[2]	H+	+265%	11,000	<50	4,000
Coweeman [G]	Primary	VL	H	H	VL[2]	H+	+80%	3,500	100	900
Kalama	Contributing[2]	VL	H	M	VL[2]	M	+110%	2,700	<50	500
Lewis [G]	Primary	VL	H	H	VL[2]	H+	+280%	2,600	<50	1,500
Salmon	Stabilizing	VL	H	M	VL	VL	--	n/a	<50	--
Washougal	Primary	VL	H	M	VL[2]	H+	+190%	2,600	<50	1,200
Clackamas (OR) [C]	Contributing	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Sandy (OR)	Contributing[1]	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Cascade L Fall										
Lewis NF [C,G]	Primary	VH	H	H	VH[1]	VH	0%	23,000	7,300	7,300
Sandy (OR) [C,G]	Primary	--[3]	--[3]	--[3]	H	VH	--[3]	--[3]	--[3]	--[3]
Cascade Spring										
Upper Cowlitz [C,G]	Primary	VL	L	M	VL[2]	H+	>500%	22,000	300	1,800
Cispus [C,G]	Primary	VL	L	M	VL[2]	H+	>500%	7,800	150	1,800
Tilton	Stabilizing	VL	VL	VL	VL	VL	0%	5,400	<100	--
Toutle	Contributing	VL	H	L	VL	M	>500%	3,100	100	1,100
Kalama	Contributing[2]	VL	H	L	VL	L	>500%	4,900	100	300
Lewis NF [C]	Primary	VL	L	M	VL	H	>500%	15,700	300	1,500
Sandy (OR) [C,G]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Gorge Fall										
L. Gorge (WA/OR)	Contributing	VL	M	L	VL[2]	M	>500%	n/a	<50	1,200
U. Gorge (WA/OR) [C]	Contributing[1]	VL	M	L	VL[2]	M	>500%	n/a	<50	1,200
White Salmon [C]	Contributing	VL	L	L	VL	M	>500%	n/a	<50	500
Hood (OR)	Primary[4]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge Spring										
White Salmon [C]	Contributing	VL	VL	VL	VL	L+	>500%	n/a	<50	500
Hood (OR)	Primary	--[3]	--[3]	--[3]	VL	VH	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[1] Increase relative to interim Plan.
[2] Reduction relative to interim Plan.
[3] Addressed in Oregon Management Unit plan.
[C] Designated as a historical core population by the TRT.
[G] Designated as a historical legacy population by the TRT.

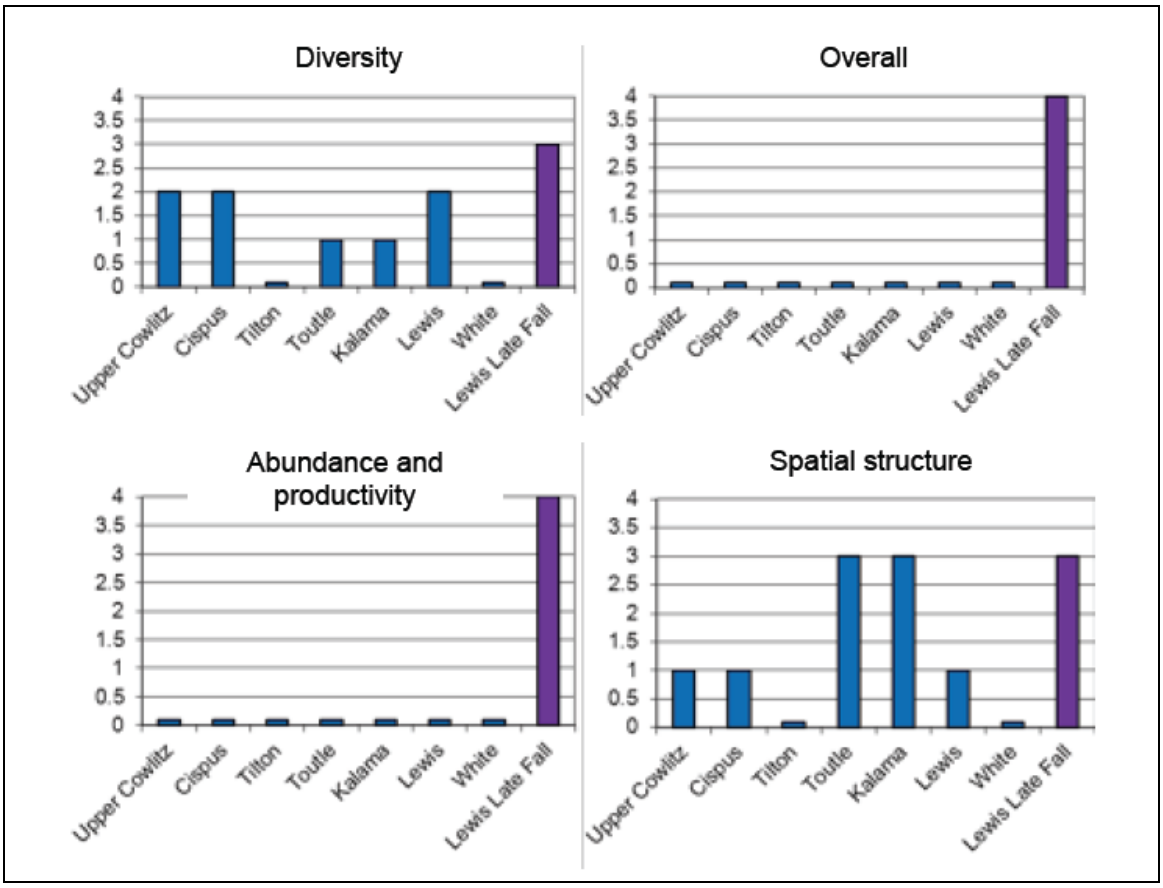


Figure 2.2.2.1: Current status of Washington lower Columbia River spring Chinook and late fall-run (bright) Chinook salmon populations for the VSP parameters and overall population risk. (LCFRB Recovery Plan 2010, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Lower Columbia River Steelhead *(Oncorhynchus mykiss)*: The DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and manmade impassable barriers in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive), and the Willamette and Hood Rivers, Oregon (inclusive), as well as ten artificial propagation programs: the Cowlitz Trout Hatchery (in the Cispus, Upper Cowlitz, Lower Cowlitz, and Tilton Rivers), Kalama River Wild (winter- and summer-run) and Lewis River Wild Winter.

Status: Today, 16 of the 23 Lower Columbia River steelhead populations have a low or very low probability of persisting over the next 100 years, and six populations have a moderate probability of persistence. Only the summer-run Wind population is considered viable. All four strata in the DPS fall short of the WLC TRT criteria for viability (Dornbush and Sihler 2013). Populations in the upper Lewis and Cowlitz watersheds remain cut-off from access to essential spawning habitat by hydroelectric dams. Projects to allow access have been initiated in the Cowlitz and Lewis systems but these have not yet produced self-sustaining populations (Ford 2011). Condit Dam on the White Salmon River was breached October 26, 2011. WDFW is currently developing watershed-specific management plans in accordance with the SSMP. As part of this planning process, WDFW is proposing to complete a thorough review of current steelhead stock status using the most up to date estimates of adult abundance, juvenile production and genetic information.

Table 2.2.2.2: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River steelhead populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast Winter										
Grays/Chinook	Primary	VH	VH	M	M[1]	H	0%[4]	1,600	800	800
Eloch/Skam	Contributing	VH	VH	M	M[1]	M+	0%[4]	1,100	600	600
Mill/Ab/Germ	Primary	H	VH	M	M[1]	H	0%[4]	900	500	500
Youngs Bay (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Big Creek (OR)	Primary	--[3]	--[3]	--[3]	H	VH	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Cascade Winter										
Lower Cowlitz	Contributing	L	M	M	L	M	+5%	1,400	350	400
Upper Cowlitz [C,G]	Primary	VL	M	M	VL[2]	H[1]	>500%	1,400	<50	500
Cispus [C,G]	Primary	VL	M	M	VL[2]	H[1]	>500%	1,500	<50	500
Tilton	Contributing	VL	M	M	VL	L	>500%	1,700	<50	200
S.F. Toutle	Primary	M	VH	H	M	H+	+35%	3,600	350	600
N.F. Toutle [C]	Primary	VL	H	H	VL[2]	H	+125%		120	600
Coweeman	Primary	L	VH	VH	L[2]	H	+25%	900	350	500
Kalama	Primary	L	VH	H	L[2]	H+	+45%	800	300	600
N.F. Lewis [C]	Contributing	VL	M	M	VL[2]	M	>500%	8,300	150	400
E.F. Lewis	Primary	M	VH	M	M[1]	H	+25%	900	350	500
Salmon	Stabilizing	VL	H	M	VL[2]	VL	0%	na	<50	--
Washougal	Contributing	L	VH	M	L[2]	M	+15%	800	300	350
Clackamas (OR) [C]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Sandy (OR) [C]	Primary	--[3]	--[3]	--[3]	L	VH	--[3]	--[3]	--[3]	--[3]
Cascade Summer										
Kalama [C]	Primary	H	VH	M	M[1]	H	0%[4]	1,000	500	500
N.F. Lewis	Stabilizing	VL	VL	VL	VL	VL	0%	na	150	--
E.F. Lewis [G]	Primary	VL	VH	M	VL[2]	H	>500%	600	<50	500
Washougal [C,G]	Primary	M	VH	M	M[1]	H	+40%	2,200	400	500
Gorge Winter										
L. Gorge (WA/OR)	Primary	L	VH	M	L[2]	H	+45%	na	200	300
U. Gorge (WA/OR)	Stabilizing	L	M	M	L[2]	L	0%	na	200	--
Hood (OR) [C,G]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Gorge Summer										
Wind [C]	Primary	VH	VH	H	H[1]	VH	0%[4]	na	1,000	1,000
Hood (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.

L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.

[1] Increase relative to interim Plan.

[2] Reduction relative to interim Plan.

[3] Addressed in Oregon Management Unit plan.

[4] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.

[C] Designated as a historical core population by the TRT.

[G] Designated as a historical legacy population by the TRT.

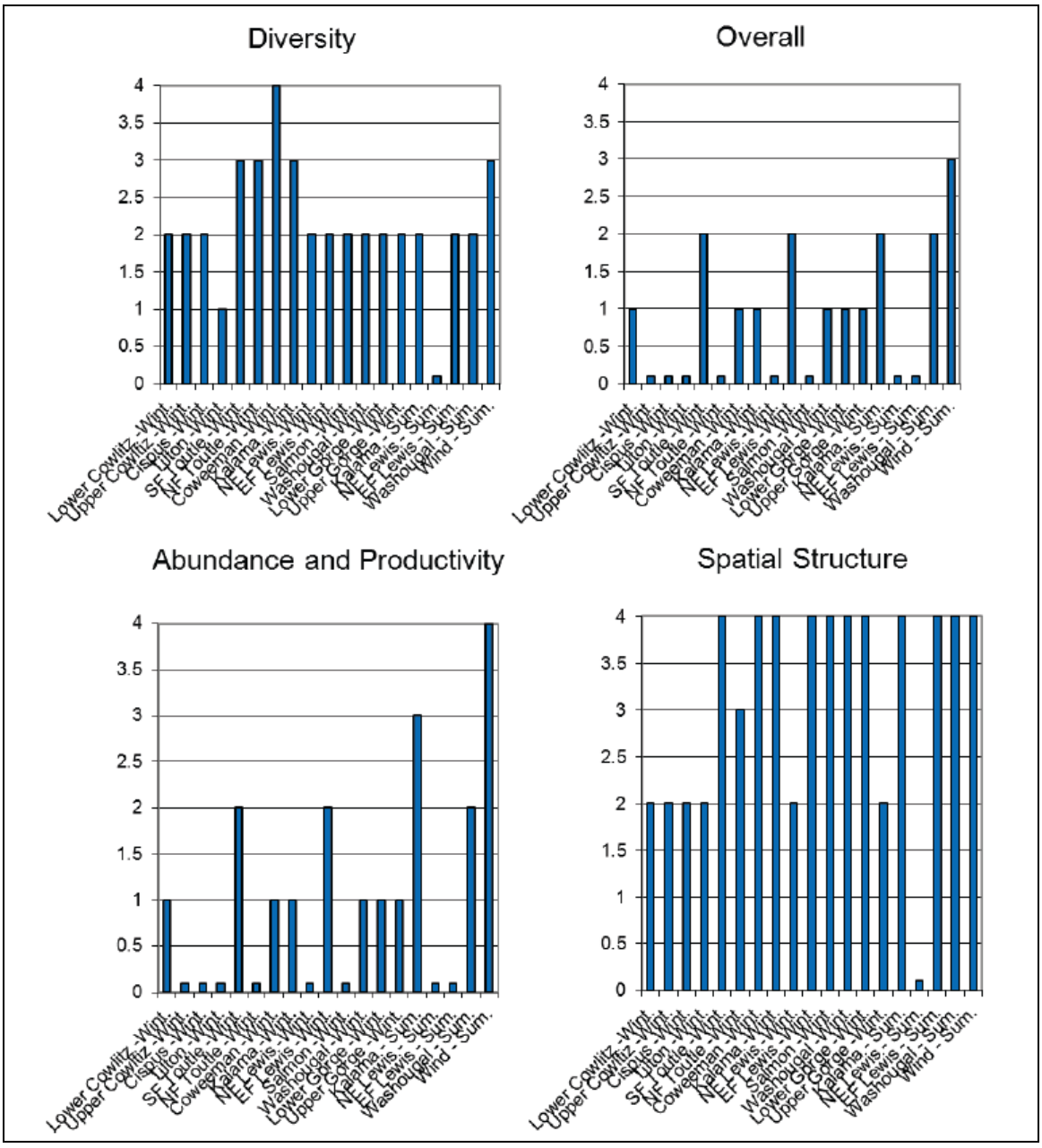


Figure 2.2.2.2: Current status of Washington LCR steelhead populations for the VSP parameters and overall population risk. (LCFRB 2010 Recovery Plan, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Lower Columbia River coho *(Oncorhynchus kisutch)*: Originally part of a larger Lower Columbia River/Southwest Washington ESU, Lower Columbia coho were identified as a separate ESU and listed as threatened on June 28, 2005. The ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers, The twenty-five artificial propagation programs include: the Grays River, Sea Resources Hatchery, Peterson Coho Project, Big Creek Hatchery, Cathlamet High School FFA Type-N Coho Program, Cowlitz Type-N Coho Program in the Upper and Lower Cowlitz Rivers, Cowlitz Game and Anglers Coho Program, Friends of the Cowlitz Coho Program, North Fork Toutle River Hatchery, Kalama River Type-N Coho Program, Kalama River Type-S Coho Program,

Washougal Hatchery Type-N Coho Program, Lewis River Type-N Coho Program, Lewis River Type-S Coho Program, Fish First Wild Coho Program, Fish First Type-N Coho Program.

Status: Status evaluations of LCR coho status, all based on WLC-TRT criteria, have been conducted since the last BRT status update in 2005 (McElhany et al. 2007, Beamesderfer et al. 2010, LCFRB 2010, Dornbusch and Sihler 2013). All of these evaluations concluded that the ESU is currently at very high risk of extinction. All of the Washington side populations are considered at very high risk, although uncertainty is high because of a lack of adult spawner surveys. The 2005 BRT evaluation noted that smolt traps indicate some natural production in Washington populations, though given the high fraction of hatchery origin spawners suspected to occur in these populations it is not clear that any are self-sustaining (Ford 2011). Since this time WDFW has implemented an ESU wide monitoring program for LCR coho which began in 2010. Preliminary results indicate that natural origin population abundance may be higher than previously thought for certain populations (WDFW, unpublished). Results from the first 3 years of monitoring should be available in the near future. Currently, 21 of the 24 Lower Columbia River coho salmon populations are considered to have a very low probability of persisting over the next 100 years, and none is considered viable (Dornbusch and Sihler 2013). All three strata in the ESU fall significantly short of the WLC TRT criteria for viability.

Table 2.2.2.3: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River coho populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast										
Grays/Chinook [L]	Primary	VL	H	VL	VL[2]	H	+370%	3,800	<50	2,400
Eloch/Skam [L]	Primary	VL	H	VL	VL[2]	H	+170%	6,500	<50	2,400
Mill/Ab/Germ [L]	Contributing	VL	H	L	VL[2]	M	>500%	2,800	<50	1,800
Youngs (OR) [L]	Stabilizing	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [L]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR) [L]	Primary[1]	--[3]	--[3]	--[3]	L	VH	--[3]	--[3]	--[3]	--[3]
Scappoose (OR) [L]	Primary	--[3]	--[3]	--[3]	M	VH	--[3]	--[3]	--[3]	--[3]
Cascade										
Lower Cowlitz [L]	Primary	VL	M	M	VL[2]	H	+100%	18,000	500	3,700
Upper Cowlitz [E, L]	Primary[1]	VL	M	L	VL	H[1]	>500%	18,000	<50	2,000
Cispus [E, L]	Primary[1]	VL	M	L	VL	H[1]	>500%	8,000	<50	2,000
Tilton [E, L]	Stabilizing[2]	VL	M	L	VL	VL[2]	0%	5,600	<50	--
Toutle SF [E, L]	Primary	VL	H	M	VL[2]	H	+180%	27,000	<50	1,900
Toutle NF [E, L]	Primary	VL	M	L	VL[2]	H	+180%		<50	1,900
Coweeman [L]	Primary	VL	H	M	VL[2]	H	+170%	5,000	<50	1,200
Kalama [L]	Contributing	VL	H	L	VL[2]	L	>500%	800	<50	500
NF Lewis [E, L]	Contributing	VL	L	L	VL[2]	L	+50%	40,000	200	500
EF Lewis [E, L]	Primary	VL	H	M	VL[2]	H	>500%	3,000	<50	2,000
Salmon [L]	Stabilizing	VL	M	VL	VL	VL	0%	na	<50	--
Washougal [L]	Contributing	VL	H	L	VL[2]	M+	>500%	3,000	<50	1,500
Clackamas (OR) [E, L]	Primary	--[3]	--[3]	--[3]	M	VH	--[3]	--[3]	--[3]	--[3]
Sandy (OR) [E, L]	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge										
L Gorge (WA/OR) [L]	Primary	VL	M	VL	VL[2]	H	+400%	na	<50	1,900
U Gorge (WA) [L]	Primary[1]	VL	M	VL	VL[2]	H	+400%	na	<50	1,900
U Gorge/Hood (OR)[E]	Contributing[4]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[1] Increase relative to interim Plan.
[2] Reduction relative to interim Plan.
[3] Addressed in Oregon Management Unit plan.
[4] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.
[E] Early run (Type S) coho stock.
[L] Late run (Type N) coho stock.
(Core and Legacy populations not designated by the TRT for coho).

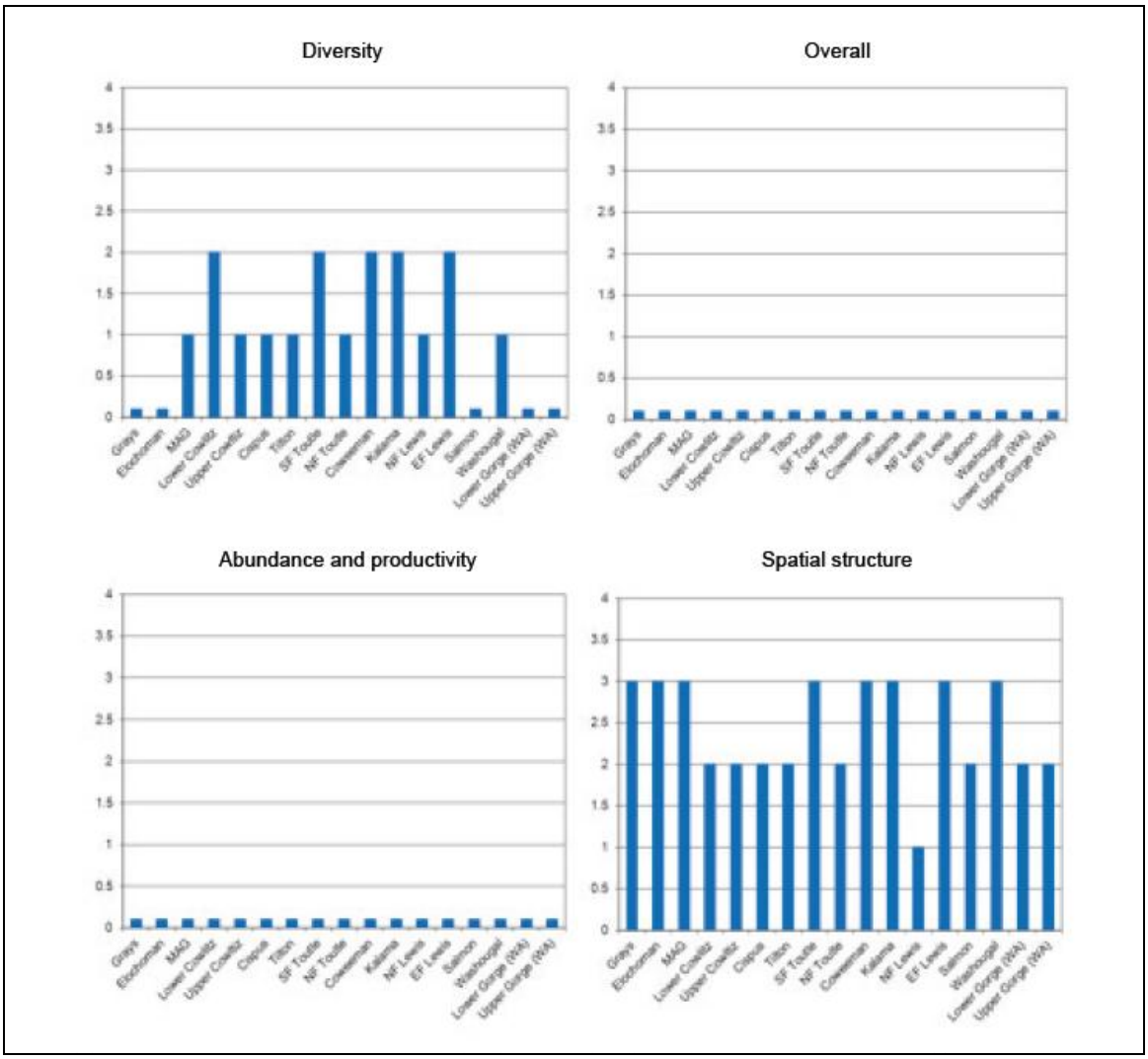


Figure 2.2.2.3: Current status of Washington LCR coho populations for the VSP parameters and overall population risk. (LCFRB 2010 recovery plan, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Columbia River chum salmon (*Oncorhynchus keta*). ESU includes all naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, as well as artificial propagation programs at Big Creek, Grays River, Lewis River, and Washougal River/Duncan Creek chum hatchery programs.

Status: The LCFRB completed a revision recovery plan in 2010 that includes Washington populations of Columbia River chum salmon. This plan includes an assessment of the current status of Columbia River chum populations, which relied and built on the viability criteria developed by the WLC-TRT (McElhany et al. 2006) and an earlier evaluation of Oregon WLC populations (McElhany et al. 2007). This evaluation assessed the status of populations with regard to the VSP parameters of A/P, spatial structure, and diversity (McElhany et al. 2000). The result of this analysis is shown in **Figure 2.2.2.3**. The analysis indicates that all of the Washington populations with two exceptions are in the overall very high risk category (also described as extirpated or nearly so). The Grays River population was considered to be at moderate risk and the Lower Gorge population to be at low risk. The very high risk status assigned to the majority of Washington populations (and all the Oregon populations) reflects the very low abundance observed in these populations (e.g., <10 fish/year) (Ford 2011). Today, 15

of the 17 populations that historically made up this ESU are so depleted that either their baseline probability of persistence is very low or they are extirpated or nearly so; this is the case for all six of the Oregon populations. Currently almost all natural production occurs in just two populations: Grays/Chinook and the Lower Gorge. All three strata in the ESU fall significantly short of the WLC TRT criteria for viability (Dornbush and Sihler 2013).

Table 2.2.2.4: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River chum populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast										
Grays/Chinook [C,G]	Primary	VH	M	H	M[1]	VH	0%[4]	10,000	1,600	1,600
Eloch/Skam [C]	Primary	VL	H	L	VL[2]	H	>500%	16,000	<200	1,300
Mill/Ab/Germ	Primary	VL	H	L	VL	H	>500%	7,000	<100	1,300
Youngs (OR) [C]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [C]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary[1]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary[1]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Cascade										
Cowlitz (Fall) [C]	Contributing	VL	H	L	VL	M	>500%	195,000	<300	900
Cowlitz (Summer) [C]	Contributing	VL	L	L	VL	M	>500%	n/a	n/a	900
Kalama	Contributing	VL	H	L	VL	M	>500%	20,000	<100	900
Lewis [C]	Primary	VL	H	L	VL	H	>500%	125,000	<100	1,300
Salmon	Stabilizing	VL	L	L	VL	VL	0%	n/a	<100	--
Washougal	Primary	VL	H	L	VL[2]	H+	>500%	18,000	<100	1,300
Clackamas (OR) [C]	Contributing	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Sandy (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge										
L. Gorge (WA/OR) [C,G]	Primary	VH	H	VH	H[1]	VH	0%[4]	6,000	2,000	2,000
U. Gorge (WA/OR)	Contributing	VL	L	L	VL	M	>500%	11,000	<50	900

Source: LCFRB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[5] Increase relative to interim Plan.
[6] Reduction relative to interim Plan.
[7] Addressed in Oregon Management Unit plan.
[8] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.
[C] Designated as a historical core population by the TRT.
[G] Designated as a historical legacy population by the TRT.

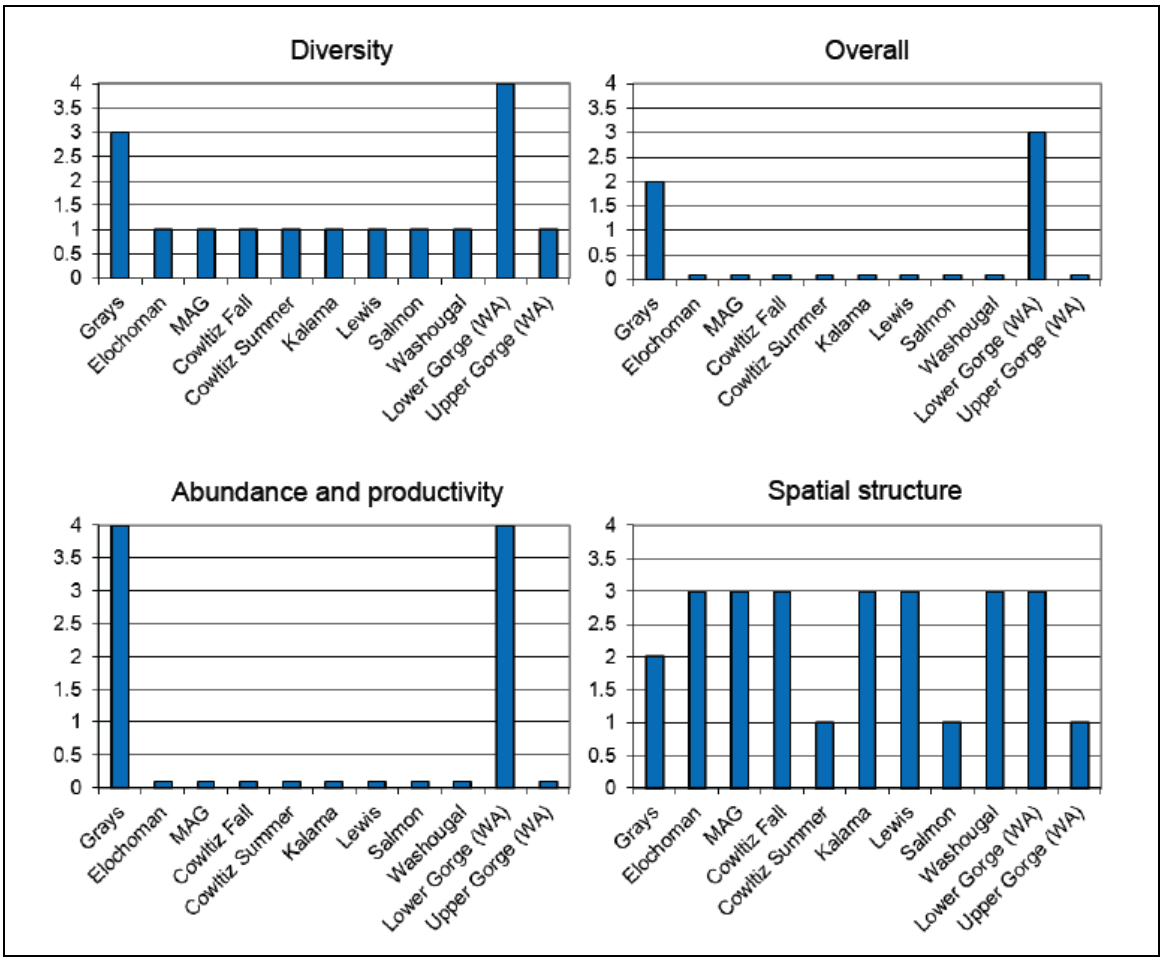


Figure 2.2.2.4: Current status of Washington CR chum populations for the VSP parameters and overall population risk. (LCFRB 2010 Recovery Plan, Chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population.

Not available for most species. See HGMP section 11.1 for planned M&E. Juvenile coho production estimates is the one measure of production in the Lower Columbia system.

Table 2.2.2.5: Lower Columbia River Washington tributary coho smolt production estimates, 1997-2009 (WDFW, Region 5).

Year	Cedar Creek	Mill Creek	Abernathy Creek	Germany Creek	Cowlitz Falls Dam	Mayfield Dam
1997	-----	-----	-----	-----	3,700	700
1998	38,400	-----	-----	-----	110,000	16,700
1999	28,000	-----	-----	-----	15,100	9,700
2000	20,300	-----	-----	-----	106,900	23,500
2001	24,200	6,300	6,500	8,200	334,700	82,200
2002	35,000	8,200	5,400	4,300	166,800	11,900
2003	36,700	10,500	9,600	6,200	403,600	38,900
2004	37,000	5,700	6,400	5,100	396,200	36,100
2005	58,300	11,400	9,000	4,900	766,100	40,900
2006	46,000	6,700	4,400	2,300	370,000	33,600
2007	29,300	7,000	3,300	2,300	277,400	34,200
2008	36,340	90,97	5,077	3,976	-----	38,917
2009	61,140	62,83	3,761	2,576	-----	29,718
2010	-----	-----	-----	-----	-----	49,171
2011	-----	-----	-----	-----	-----	43,831

Source: LCR FMEP Annual Report 2010 and WDFW Data 2012.

- Provide the most recent 12 year annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Table 2.2.2.6: Spring Chinook salmon total spawner abundance estimates in LCR tributaries, 2000-2012.

Year	Cowlitz	Kalama	Lewis
2000	266	34	523
2001	347	578	754
2002	419	898	498
2003	1,953	790	745
2004	1,877	358	529
2005	405	380	122
2006	783	292	857
2007	74	2,150	264
2008	425	364	40
2009	763	34	80
2010	711	0	160
2011	1,359	26	120
2012	1,359	28	200

Source: Joe Hymer, WDFW Annual Database 2012. Does not include adults transported to the upper Cowlitz, Lewis or released above Kalama Falls Hatchery.

Table 2.2.2.7: Fall Chinook salmon total spawner abundance estimates in LCR tributaries, 2000-2011[a].

Year	Elochoman River	Coweeman River[a]	Grays River	Skamokawa Creek	Cowlitz River	Green River (Toutle)	SF Toutle River	Kalama River	EF Lewis River	NF Lewis River	Washougal River
2000	884	424	80	482	2,100	1,580	204	3,877	391	6,504	2,757
2001	230	251	104	3	1,979	1,081	102	3,451	245	4,281	1,704
2002	332	566	390	7	3,038	5,654	216	10,560	441	5,518	2,728
2003	2,204	753	149	529	2,968	2,985	327	9,272	607	11,519	2,678
2004	4,796	1,590	745	2,109	4,621	4,188	618	6,680	918	13,987	10,597
2005	6,820	1,090	387	588	10,329	13,846	140	24,782	727	18,913	3,444
2006	7,581	900	82	372	14,427	7,477	450	18,952	1,375	17,106	6,050
2007	194	140	99	36	2,724	961	30	1,521	308	10,934	2,143
2008	782	95	311	253	1,334	824	45	2,617	236	4,268	3,182
2009	231	147	93	139	2,156	1,302	66	4,356	110	6,112	2,995
2010	1,883	1,330	12	268	2,762	605	NE	3,576	314	8,908	4,529
2011	508	2,148	353	41	1,616	668	NE	10,639	334	14,033	2,961

Source: Ron Roler, WDFW Natural Spawn Progress Reports 2012.

* Estimates of total adult and jack fall Chinook. May include fish put upstream of hatchery weirs.

Table 2.2.2.8: Wild winter steelhead escapement estimates for select SW Washington DPS populations, current WDFW escapement goals and LCSRP abundance targets.

Location	Grays River	Elochoman/ Skamokawa	Mill/Abernathy/ Germany
WDFW Escapement Goal	**1,486**	**853**	**508**
LCSRP Abundance Target	**800**	**600**	**500**
2000	1,064	650	380
2001	1,130	656	458
2002	724	370	354
2003	1,200	668	342
2004	1,132	768	446
2005	396	376	274
2006	718	632	398
2007	724	490	376
2008	764	666	528
2009	568	222	396
2010	422	534	398
2011	318	442	270
3-year average	**436**	**399**	**355**
5-year average	**559**	**471**	**394**
10-year average	**697**	**517**	**378**

Source: WDFW Data 2012

Table 2.2.2.9: Wild winter steelhead escapement estimates for select SW Washington DPS populations, current WDFW escapement goals and LCSRP abundance targets.

Location	Coweeman	SF Toutle	NF Toutle/ Green	Kalama	EF Lewis	Washougal
WDFW Escapement Goal	**1,064**	**1,058**	**NA**	**1,000**	**1,243**	**520**
LCSRP Abundance Target	**500**	**600**	**600**	**600**	**500**	**350**
2000	530	490	----	921	NA	NA
2001	384	348	----	1,042	377	216
2002	298	640	----	1,495	292	286
2003	460	1,510	----	1,815	532	764
2004	722	1,212	----	2,400	1,298	1,114
2005	370	520	388	1,856	246	320
2006	372	656	892	1,724	458	524
2007	384	548	565	1,050	448	632
2008	722	412	650	776	548	732
2009	602	498	699	1,044	688	418
2010	528	274	508	961	336	232
2011	408	210	416	622	308	204
3-year average	**513**	**327**	**541**	**876**	**444**	**285**
5-year average	**529**	**388**	**568**	**891**	**466**	**444**
10-year average	**487**	**648**	***588**	**1,374**	**515**	**523**

Source: WDFW Data 2012.
* 7-year average for NF Toutle/Green.

Table 2.2.2.10: Wild summer steelhead population estimates for LCR populations from 2001 to 2011, current WDFW escapement goals, and LCSRP abundance targets.

Location	Kalama	EF Lewis	Washougal	Wind
WDFW Escapement Goal	**1,000**	**NA**	**NA**	**1,557**
LCSRP Abundance Target	**500**	**500**	**500**	**1,000**
2001	286	271	184	457
2002	454	440	404	680
2003	817	910	607	1,096
2004	632	425	NA	861
2005	400	673	608	587
2006	387	560	636	632
2007	361	412	681	737
2008	237	365	755	614
2009	308	800	433	580
2010	370	602	787	788
2011	534	1,084*	956*	1,468
3-year average	**404**	**829**	**725**	**945**
5-year average	**362**	**653**	**722**	**837**
10-year average	**450**	**627**	**652**	**804**

Source: WDFW Data 2012.
* Preliminary estimates.

Table 2.2.2.11: Population estimates of chum salmon in the Columbia River.

Location	2002	2003	2004	2005	2006	2007	2008	2009	2010[a]	2011[a]
Crazy Johnson Creek	---	---	966	1,471	3,639	759	1,034	981	677	2,374
WF Grays River	---	---	9,015	1,324	1,232	1,909	800	994	1,967	7,002
Mainstem Grays River	---	---	4,872	1,400	1,244	1,164	886	750	3,467	1,848
I-205 area	3,468	2,844	2,102	1,009	862	544	626	1,132	2,105	4,947
Multnomah area	1,267	1,130	665	211	313	115	28	102	427	641
St Cloud area	---	137	104	92	173	9	1	14	99	509
Horsetail area	---	---	106	40	63	17	33	6	45	183
Ives area[b]	4,466	1,942	363	263	387	145	168	141	214	162
Duncan Creek[c]	13	16	2	7	42	9	2	26	48	85
Hardy Creek	343	392	49	73	104	14	3	39	137	173
Hamilton Creek	1,000	500	222	174	246	79	114	115	247	517
Hamilton Spring Channel	794	363	346	84	236	44	109	91	187	324
Grays return[d]	12,041	16,974	15,157	4,327	6,232	3,966	2,807	2,833	6,399	11,518
I-205 to Bonneville return	11,351	7,324	3,959	1,953	2,426	976	1,084	1,666	3,509	7,541
Lower Columbia River Total	23,392	24,298	19,116	6,280	8,658	4,942	3,891	4,499	9,908	19,059

Source: Todd Hillson - WDFW Chum Program 2012.

[a] Data for 2010 and 2011 is preliminary.

[b] Ives area counts are the carcass tagging estimate plus fish removed for broodstock, except for 2007 and 2008, which is area under the curve.

[c] Totals for Duncan Creek do not include broodstock brought in from mainstem spawning areas, adult trap catch or surveys below monitoring weirs only..

[d] Grays return totals include natural spawners and removed for broodstock.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Cowlitz Spring Chinook: The proportion of effective hatchery-origin spawners (pHOS) should be less than 5% of the naturally spawning population for this segregated program, per HSRG guidelines (2004) for a program associated with a Primary natural population. Primary population is in the upper Cowlitz River. Currently hatchery and wild fish are used for reintroduction in the upper basin. The long term goal is to reduce the number of hatchery fish in the upper basin but will be driven by the productivity and successful collection of natural origin fish from the upper basin. In the 2010 Recovery Plan, The is no lower river population of Spring Chinook in the Cowlitz River.The lower river population is not currently managed for pHOS. See **Table 2.2.3.3** for numbers of unmarked fish passed upstream for spawning.

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

The following hatchery activities are identified in the ESA Section 7 Consultation "Biological Opinion on Artificial Propagation in the Columbia River Basin" (March 29, 1999). In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependent on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. Broodstock collection activities will directly handle listed fish

and will have "take" tables associated with direct broodstock collection or with listed fish lost during handling for release. These tables are found the end of this HGMP.

Broodstock Program:
Broodstock Collection: The Cowlitz Barrier Dam adult collection facility enables the program to discriminate all returning adult fish according to hatchery- and natural-origin fish, since the program fish releases are 100% marked. The ability to discriminate hatchery/natural origin fish assures that the program/stock adheres to proper handling of returns during broodstocking activities, and that only hatchery-origin marked fish are used for brood. All wild salmonids collected are transported to the upper Cowlitz basin and tributaries for natural spawning. Mortality during transport is reported at the end of this document.

Genetic introgression: The spring Chinook stock is a mixture of all historical populations of Cowlitz River spring Chinook populations and genetically representative of the legacy population. Integration levels was unknown prior to mass–marking, which began with the 1996 brood (releases in 1998). Since mass-marking, only marked hatchery-origin adults have been used as broodstock and in the short term, naturally produced adults will not be incorporated into the hatchery population. Eventually, integration of the hatchery and natural components of the run will be possible once a self-sustaining run is established in the basin.

Rearing Program:
Operation of Hatchery Facilities: Facility operation impacts include water withdrawal, effluent, and intake compliance (see **HGMP section 4.2**). Effluent at outfall areas is rapidly diluted with mainstem flows and operation is within permitted NPDES guidelines.

Disease: Over the years, rearing densities, disease prevention and fish health monitoring have greatly improved the health of the hatchery programs. *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (IHOT 1995) Chapter 5 have been instrumental in reducing disease outbreaks. While pathogens occur and may affect fish in the wild, they are believed to go undetected, and are quickly removed through predation. Furthermore, while the Cowlitz Salmon Hatcheries has been noted as potential sources of fish pathogens including bacterial kidney disease, *Ceratomyxa shasta*, and IHNV, these diseases are also present in the natural spawning populations (Tacoma Power 2000).

In addition, although pathogens may cause post release mortality in fish from hatcheries, there is little evidence that hatchery-origin fish routinely infect natural populations of salmon and steelhead in the Pacific Northwest (Enhancement Planning Team 1986 and Stewart and Bjornn 1990). Prior to release, the health and condition of the hatchery population is established by the Cowlitz Fish Health Specialist. This is commonly done one to three weeks prior to release, and up to six weeks on systems with pathogen-free water and little or no history of disease. Indirect take from disease is unknown.

Release:
Hatchery Production/Density-Dependent Effects: Current levels of hatchery production are described in the FHMP (update 2011) including after the remodeling and phase-in plan, and the *Disease Management Plan* (Tacoma Power 2008). Lower river production is also dependent on agreement of future up-river credit mechanisms between WDFW and Tacoma Power (FHMP section 3.7). Any future hatchery consultation will be in the overall context or to meet the goal of reestablishing self-sustaining population levels consistent with a viable ESU scenario. When the plan is updated, NOAA Fisheries will be consulted to determine if re-initiation of the consultation is warranted. At which time, NOAA Fisheries will consider the potential for both beneficial and adverse effects to listed species.

Potential Cowlitz hatchery spring Chinook predation and competition effects on listed salmonids and eulachon. The proposed annual production goal for on-station program is around 500,000 yearlings at 16 fpp (143 mm fl), released in November, 800,000 yearlings at 8fpp (180 mm fl),

and approxiametly 440,000 yearlings 5fpp (210 mm fl) released in March/April; the FOC program, released in the lower river, is around 55,000 yearlings at around 5 fpp (210 mm fl), released in March. Kinsel et al. 2009 (**Table 2.2.3.1**) indicates that the majority of naturally-produced Chinook and coho would not be present in November, and would be a similar size during out-migration by March. Cowlitz Salmon Hatchery fish are released directly to the lower river at RKm 78.8 and Toledo Sand and Gravel net pen Chinook are released directly to the lower river at RKm 41.1; both are well below the upper river productivity. Although the on-station release is not totally volitional, most fish quickly vacate the pond as soon as screens are removed, and based on past history, time and size release parameters, should out-migrate quickly upon release. The FOC releases are forced, but based on past history, time and size release parameters, fish should out-migrate quickly

Table 2.2.3.1: Peak migration timing and average fork length (mm) of out-migrant juvenile Chinook, coho and steelhead captured in rotary screw traps on Mill, Germany and Abernathy creek, Lower Columbia River, 2008.

Stream	Chinook		Coho		Steelhead	
	Avg Size (mm)	Peak Migration	Avg Size (mm)	Peak Migration	Avg Size (mm)	Peak Migration
Mill Cr	37.0	Mar 10-Apr 13	104.2	Mar 17-23	154.5	Apr 28-May 4
Germany Cr	39.8	Mar 17-23	115.3	May 19-25	177.8	May 12-18
Abernathy Cr	37.9	Mar 31 – Apr 6	112.1	May 19-25	163.8	May 12-18

Source: Kinsel et al 2009.

Both juvenile and adult salmonids have been documented to feed on eulachon (Gustafson et al. 2010). Predation of eulachon by Chinook reared in this program may occur, however it is unknown to what degree such predation may occur.

Table 2.2.3.2: Annual smolt collection by species and origin at the Cowlitz Falls Fish Facility from 1997 through 2013.

	Chinook			Steelhead			Coho		Cutthroat	
	Sub-yearling		Unmarked							Total
Season	Hatchery[1]	Unmarked	Yearling	Hatchery	Natural	Unmarked[2]	Unmarked[3]	Unmarked	Unmarked	Smolt
2013		21,760	508			6,757		213,703	380	243,108
2012		23,165	28	0	1	981		10,504	152	34,831
2011	1,234	4,819	4	1	220	5,742		34,632	314	46,966
2010	21,690	10,121	45	7	3,256	9,324		110,378	485	155,306
2009	32,218	2,816	28	8,145	1,586	4,407		40,697	281	90,178
2008	13,870	1,135	10	12,200	837	2,664		14,315	185	45,216
2007	15,778	284	55	19,414	2,401	8,117		104,277	715	151,041
2006	35,997	5,330	54	19,747	1,768	9,585		74,228	738	147,447
2005	11,554	3,222	35	25,345	3,561	17,338		264,921	1,026	327,002
2004	21,195	8,382	20	18,714	5,042	11,276		128,148	718	193,495
2003	26,982	7,741	18	16,463	170	14,740		173,540	1,280	240,934
2002	20,733	5,595	0	591	23,162	5,247		55,029	990	111,347
2001	36,450		25	4,901	33,491	17,807		334,718	1,077	428,469
2000	32,704			89	16,404	17,023	106,880		1,343	174,443
1999	8,878			31	10,783	10,001	15,120		545	45,358
1998	14,917			22	25,921	15,691	109,974		888	167,413
1997	22,815			37	15,621	2,777	3,673		260	45,183
Total	317,015	94,370	830	125,707	144,224	159,477	235,647	1,559,090	11,377	2,647,737

1] 2004-08 numbers based on RV clipped fish captured. 2002 and 2003 based on relative size.

2] Unmarked fish from 2004 onward are assumed to be naturally produced. 2002 and 2003 unmarked numbers based on VIE marking a portion of fry plant. 1997-2001 numbers are a mix of unmarked hatchery fry plants and natural production.

3] Coho smolts from 1997-2000 were a mix of hatchery fry and natural production. Coho smolts from 2001 onward are naturally produced.

Table Source - Draft Annual Report for the Cowlitz Falls from 1997- 2013.

Residualism: To maximize smolting characteristics and minimize residualism, WDFW adheres to a combination of acclimation, volitional release strategies, size, and time guidelines.

- Condition factors, standard deviation and co-efficient of variation (CV) are measured throughout the rearing cycle and at release.
- Feeding rates and regimes throughout the rearing cycle are programmed to satiation feeding to minimize out-of-size fish and programmed to produce smolt size fish at date of release.
- Based on past history, fish have reached a size and condition that indicates a smolted condition at release.
- Releases occur within known time periods of species emigration from acclimated ponds.
- Releases from these ponds are volitional with large proportions of the populations moving out initially with the remainder of the population forced out within a few days.
- Minimal residualism from WDFW Chinook programs following these guidelines has been indicated from snorkeling studies on the Elochoman River (Fuss et al. 2000) and on Nemah and Forks Creek (Riley et al. 2004). In extensive surveys conducted on the Lewis River, Hawkins and Tipping (1999) found no residualized hatchery spring Chinook. Indirect take from residualism is unknown.

Monitoring:

Associated monitoring Activities: Interaction between hatchery and wild adult salmonids will be managed by monitoring key tributary escapements of coho, steelhead, cutthroat and chum. Interaction between hatchery-released fish and wild fish in the lower Cowlitz will be studied and may result in review of release strategies.

The following monitoring baseline activities are conducted in the Lower Columbia Management Area (LCMA) for adult steelhead and salmon: redd surveys are conducted for winter steelhead in the SF Toutle, Coweeman, EF Lewis and Washougal rivers. Redd surveys are also conducted in the Cowlitz River for fall and spring Chinook. Mark-recapture surveys provide data for summer steelhead populations in the Wind and Kalama rivers. Mark-recapture carcass surveys are conducted to estimate populations of Chinook salmon in Grays, Elochoman, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis, rivers and Skamokawa, Mill, Abernathy, and Germany creeks and for all chum salmon populations. Snorkel surveys are conducted for summer steelhead in the EF Lewis, Washougal rivers. Trap counts are conducted on the Cowlitz, NF Toutle, Kalama, and Wind rivers and on Cedar Creek a tributary of the NF Lewis River. Area-Under-the-Curve (AUC) surveys are conducted to collect population data for chum salmon in Grays River and Hardy and Hamilton Creeks. All sampling of carcasses and trapped fish include recovery of coded wide tagged (CWT) fish for hatchery or wild stock evaluation. Downstream migrant trapping occurs on the Cowlitz, Kalama, NF Lewis, and Wind rivers, Cedar Creek, and will expand to other basins as part of a salmonid life cycle monitoring program to estimate freshwater production and natural-origin smolt-to-adult survival rates. Any take associated with monitoring activities is unknown but all follow scientific protocols designed to minimize impact. An intensive monitoring and evaluation program was recently initiated in the Cowlitz basin.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Table 2.2.3.3: Disposition of unmarked (no adipose fin-clip) spring Chinook returning to Cowlitz Salmon Hatchery.

Brood Year	Mortality
2007	1
2008	0

2009	1
2010	1
2011	0
2012	3
2013	0

Source: WDFW Annual Escapement Reports.
*NOTE – Plants refers to fish passed upstream to spawn.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See "take" tables at the end of this HGMP. The impacts from harvest are included in the FMEPs.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

No situations are expected to occur where take would exceed ESA limits. If significant numbers of wild salmonids are observed impacted by this operation, then staff would inform the WDFW District Biologist, Fish Health Specialist or Area Habitat Biologist who, along with the Hatchery Complex Manager, would determine an appropriate plan and consult with NOAA-NMFS for adaptive management review and protocols.

Handling and release of wild spring Chinook in broodstock trapping operations is monitored and take observations have been rare. Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance.

3 SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. Hood Canal Summer Chum Conservation Initiative) or other regionally accepted policies (e.g. the NPPC Annual Production Review Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

WDFW has several policies/plans that help inform management decisions regarding the HGMPs currently under review. These policies include:

1. Hatchery and Fishery Reform Policy (Commission Policy C3619)
2. The Conservation and Sustainable Fisheries Plan (draft)
3. The Hatchery Action Implementation Plans (HAIP)
4. Lower Columbia Salmon Recovery Plan (LCSRP)

Descriptions of these policies and excerpts are shown below:

Policies/Plans – Key Excerpts

Hatchery and Fishery Reform Policy: Washington Department of Fish and Wildlife Commission Policy C-3619. WDFW adopted the Hatchery and Fishery Reform Policy C-3619 in 2009. Its purpose is to advance the conservation and recovery of wild salmon and steelhead by promoting and guiding the implementation of hatchery reform. The intent of hatchery reform is to improve hatchery effectiveness, ensure compatibility between hatchery production and salmon recovery plans and rebuilding programs, and support sustainable fisheries. WDFW Policy C-3619 works to promote the conservation and recovery of wild salmon and steelhead and provide fishery-related

benefits by establishing clear goals for each state hatchery, conducting scientifically defensible-operations, and using informed decision making to improve management. It is recognized that many state operated hatcheries are subject to provisions under *U.S. v Washington* (1974) and *U.S. v Oregon* and that hatchery reform actions must be done in close coordination with tribal co-managers. Washington Fish and Wildlife Commission Policy: POL-C3619.

Guidelines from the policy include:

1. Use the principles, standards, and recommendations of the Hatchery Scientific Review Group (HSRG) to guide the management of hatcheries operated by the Department.
2. Develop watershed-specific action plans that systematically implement hatchery reform as part of a comprehensive, integrated (All-H) strategy for meeting conservation and harvest goals at the watershed and Evolutionarily Significant Unit (ESU)/Distinct Population Segment (DPS) levels. Action Plans will include development of stock (watershed) specific population designations and application of HSRG broodstock management standards.

Conservation and Sustainable Fisheries Plan (*CSFP*)*:* The CSFP is a draft plan that has been developed to meet WDFW's responsibilities outlined in the Lower Columbia Salmon Recovery Plan (LCSRP) and address the HSRG suggested solutions and achieve HRSG standards for primary, contributing and stabilizing populations. The plan describes the implementation of changes to hatchery and harvest programs and how they assist in recovery and achieve HSRG guidelines. The draft plan also identifies Viable Salmonid Population (VSP) parameters that will be addressed.

Hatchery Action Implementation Plans (*HAIP*)*:* The HAIPs illustrate how WDFW is implementing hatchery programs to incorporate the HSRG guidelines. The plans provide the current programs and explain the future goals.

Lower Columbia Salmon Recovery Plan (*LCSRP*)*:* Some sub-basins will be free of hatchery influence and hatchery programs. In other sub-basins, hatchery programs will serve specific conservation and harvest purposes consistent with goals for naturally-spawning populations. The mosaic of programs is designed to ensure that overall each DPS will be naturally self-sustaining.

Strategies

1. Reconfigure production-based hatchery programs to minimize impacts on natural populations and complement recovery objectives.
2. Adaptively manage hatcheries to respond to future knowledge, enhance natural production, and improve operational efficiencies.

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Future Brood Document. Hatchery salmon and steelhead production levels are detailed in the annual Future Brood Document, a pre-season planning document for fish hatchery production in Washington State for the upcoming brood stock collection and fish rearing season (July 1 – June 30).

Cowlitz Basin Fish Management Plan. The Department of Fish and Wildlife has developed a framework for a fish management plan for the Cowlitz River Basin. This plan is intended to provide management direction for fish protection and restoration in a manner that is consistent with the Endangered Species Act (ESA) and the Wild Salmonid Policy (WSP). The Wild Salmonid Policy was developed by WDFW in response to a mandate from the Washington State Legislature (ESHB 1309) in 1993.

Cowlitz Hatchery Mitigation Agreement (*FERC Project #2016*). The new thirty-five year license was issued March 13, 2002 (effective on July 18, 2003). The new license requires formation of the Cowlitz Fisheries Technical Committee (FTC), which includes NMFS, USFWS, WDFW, WDOE, American Rivers/Trout Unlimited, the Yakama Nation, and Tacoma Power. The FERC license was amended July 2004, based on NOAA's Biological Opinion that required Tacoma Power to achieve a fish passage survival goal of 75-95% (with best available technology). Tacoma Power has published an annual progress report since 2005.

Cowlitz Fisheries and Hatchery and Management Plan (*FHMP*). The FHMP is part of the new Settlement Agreement (Article 6), that identifies the quantity and size of fish produced at the hatcheries, the rearing and release strategies for each stock, plans for funding on-going monitoring and evaluation, and management strategies consistent with the objective of maximizing natural-origin fish production. The plan requires updates every six-years.

Cowlitz Falls Project- Lewis County Public Utility District (*PUD*) (*FERC No. 2833*). The Lewis County PUD No. 1 constructed a hydroelectric project on the Cowlitz River, which was completed in 1994. BPA constructed and oversees the operation of a downstream fish collection facility at the dam. NOAA issued a Biological Opinion dated June 2, 2009.

See also **HGMP section 3.1** above.

3.3 Relationship to harvest objectives.

Total annual harvest is dependent on management response to annual abundance in Pacific Salmon Commission (PSC - U.S./Canada), Pacific Fishery Management Council (PFMC - U.S. ocean), and Columbia River Compact forums. WDFW has submitted to NOAA Fisheries a *Fisheries Management and Evaluation Plan* (FMEP) for all lower Columbia River tributaries and has updated this document after coho were listed under ESA.

3.3.1 Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Harvest on targeted hatchery fish: Spring Chinook from the Cowlitz River are harvested in a variety of sport and commercial fisheries, and are important contributors to Washington ocean sport and troll fisheries and to the Columbia River estuary sport (Buoy 10) fishery (**Table 3.3.1.1**). Ocean and mainstem Columbia River fisheries are managed for Snake River and Coweeman River wild fall Chinook Endangered Species Act (ESA) harvest rate limits which limits the harvest of Cowlitz Chinook. Based on coded-wire tag analysis of hatchery-origin fish, most exploitation historically occurred in ocean fisheries, primarily in Washington and off the west coast of Vancouver Island.

Table 3.3.1.1: Cowlitz Salmon Hatchery spring Chinook fishery contributions.

Brood Years: 2000 (Sub-yearling) and 2000-2009 (Yearling)[b] Fishery Years:2004 (Sub-yearling) and 2004-2013 (Yearling)			
	Average SAR%[a]	**0.94**	**0.94**
Agency	**Non-WA Fishery**	*% of total Survival*	
		Sub-yearlings	*Yearlings*
ADFG	All	---	*0.85*
CDFO	All	*12.18*	*10.52*
NMFS	All	---	*0.64*
NWFSC	All	---	*0.37*
Agency	**OR Fishery**	*Sub-yearlings*	*Yearlings*
ODFW	10- Ocean Troll	*14.49*	*4.86*
ODFW	21- Columbia R. Gillnet	*3.12*	*2.69*

ODFW	40- Ocean Sport	*1.53*	*1.16*
ODFW	44- Columbia R. Sport	*1.03*	*1.81*
ODFW	45- Estuarine Sport	---	*0.25*
ODFW	46- Freshwater Sport[c]	---	*0.02*
ODFW	61- Test Fishery Net	---	*0.01*
ODFW	72- Juvenile Sampling - Seine (Marine)	---	*0.03*
Agency	**WA Fishery**	*Sub-yearlings*	*Yearlings*
WDFW	10- Ocean Troll	*0.59*	*2.05*
MAKA	15- Treaty Troll	---	*1.76*
WDFW	15- Treaty Troll	*0.75*	*0.13*
WDFW	23- PS Net	---	*0.02*
WDFW	40- Ocean Sport	---	*0.03*
WDFW	41- Ocean Sport- Charter	---	*2.99*
WDFW	42- Ocean Sport- Private	*2.98*	*3.17*
WDFW	45- Estuarine Sport	---	*0.63*
WDFW	46- Freshwater Sport[d]	---	*11.98*
WDFW	50- Hatchery Escapement	---	*47.23*
WDFW	50- Hatchery Escapement (Strays)[e]	*63.34*	*1.09*
WDFW	54- Spawning Grounds[f]	---	*5.70*
	Total	*100.0*	*100.0*

[a] Average SAR% = (tags recovered/tags released).

[b] 2009 data preliminary and represents a minimum estimate.

[c] Based on recoveries in the Willamette River.

[d] Freshwater Sport based on WDFW Catch Record Card (CRC) data.

[e] Includes recoveries at Kalama Falls and Lewis River Hatcheries.

[f] Includes recoveries in WRIA 8, 26 and 27.

Source: RMIS 2014.

Lower Cowlitz Spring Chinook

Natural Production	Recent Past (2009)	A Segregated Hatchery Population Biological Targets	Options to meet Long-term Goals A
ductivity (Smolts/Spawner)	0		0
Capacity (Smolts)	0		0
SAR	5.50%		5.50%
Fitness	0.50		0.50
PNI	-	-	-
Effective pHOS	100%	-	100%
ɔloitation Rate-All Fisheries	47%		47%
NOR Abundance potential	0	-	0
Hatchery Production			
Lower Cowlitz Program	971,964		1,801,949
Upper Cowlitz Program	-		-
SAR	0.9%		0.8%
Stray Rate	13.00%		13.00%
pNOB	0%		0%
ɨ-terminal Exploitation Rate	37%		37%
Terminal Harvest Rate	15%		15%
Expected Catch	3,133		5,492
Terminal Catch	790		1,385
Hatchery Surplus*	3,646		6,333

* includes fish from Upper Cowlitz Program transported to Upper Cowlitz

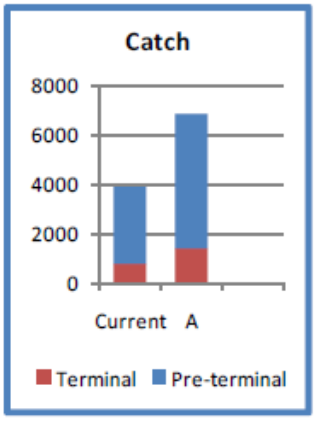
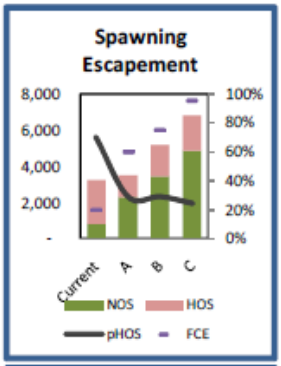


Figure 3.3.1.1: Biological targets, key assumptions and expected outcomes under recent conditions and under future options to meet long-term harvest and conservation goals for Lower Cowlitz spring Chinook (Source: FHMP update 2011).

Upper Cowlitz Spring Chinook

Natural Production	Recent Past (Current)	A Primary Population Biological Targets	Options to meet Long-term Goals A	B	C
Productivity (Smolts/Spawner)	37		67	67	69
Capacity (Smolts)	99,345		178,877	179,427	183,865
SAR	1.10%		3.30%	4.13%	5.23%
FPS	20%		60%	75%	95%
Fitness	0.5		0.90	0.90	0.93
PNI	-	> 0.67	0.78	0.78	0.80
Effective pHOS	70%	< 30%	29%	29%	24%
Seg. pHOS	70%	< 5%			
Terminal Harvest Rate	1%		1%	1%	1%
NOR Abundance potential	833	> 3,600	2,308	3,433	4,850
Hatchery Production					
Release (from Hatchery)	-		69,287	69,287	69,287
pNOB	0%		100%	100%	100%
Adults Transported above CF	2,500		1,200	1,800	2,000
Harvest Rate	3%		3%	3%	3%
Expected Catch in Upper Cowlitz	83		59	88	109



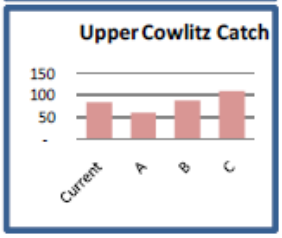


Figure 3.3.1.2: Biological targets, key assumptions and expected outcomes under recent conditions and under future options to meet long-term harvest and conservation goals for Upper Cowlitz spring Chinook (Source: FHMP update 2011).

3.4 Relationship to habitat protection and recovery strategies.

The impact associated with Tacoma Power's and Lewis PUD's continued operation of hydroelectric facilities including the dams creating Mayfield Lake, Riffe Lake and Lake Scanewa are major factors that affected natural production of resident and anadromous fish species. Project impacts to fish include:

(1) Impacts to resident and anadromous fishes in the reservoirs, downstream, and upstream caused by project-related barriers, false attraction, entrainment in intakes, and other impediments to fish migration.
(2) Impacts to resident and anadromous fishes in the reservoirs, downstream, and upstream caused by project-related mitigation hatchery fish interactions with remaining wild fish.
(3) Impacts to resident and anadromous fishes in reservoirs from fluctuations in reservoir level.
(4) Impacts to resident and anadromous fishes downstream of the dams caused by project-related flow-dependent habitat changes.
(5) Impacts to resident and anadromous fishes downstream of the dams caused by project-related flow fluctuations.
(6) Impacts to resident and anadromous fishes in the reservoir and downstream caused by project-related channel changes stemming from alteration of natural sediment transport.
(7) Changes in dynamics of fish-predator interactions resulting from change in fish escape options.
(8) Changes in water quality (e.g., temperature, dissolved gases, suspended sediment, pollutants) which can impact fish (and wildlife).
(9) Interruption of the transport of large wood and nutrients from upstream to downstream reaches and nutrient transport upstream in the form of adult anadromous fish.
(10) Inundation of anadromous fish spawning, incubation, and rearing habitat by Mayfield, Mossyrock and Cowlitz Falls dams, resulting in loss of anadromous fish production from the inundated reaches.

Several FERC Settlement Agreement articles address passage problems in the system including: 1) Downstream Fish Passage for Riffe Lake and Cowlitz Falls; 2) Downstream passage for Mayfield Lake; and 3) Upstream Fish Passage for the Barrier Dam, Mossyrock and Mayfield. The articles also deal with future proposals and improvement needed for restoring processes upstream and down. Afish habitat fund of up to $3 million for identified projects in the lower Cowlitz River has been created (Article 11). In addition, a fish habitat fund of $15 million for identified projects in the upper Cowlitz River basin has been created (Article 3) in case further efforts towards volitional upstream passage are suspended for the current license period.

Additional Processes:
The following processes have included habitat identification problems, priority fixes and evolved as key components to The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004).

Sub-Basin Planning - Regional sub-basin planning processes include the Cowlitz River Sub-basin Salmon and Steelhead Production Plan, September 1, 1990 with a more recent Draft Cowlitz River Sub-basin Summary (May 17, 2002) was prepared for the Northwest Power Planning Council. The Sub-basin efforts provided initial building blocks for the LCFRB regional recovery plan. The Lower Columbia fish Recovery Board (LCFRB) has adopted The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004) with the understanding that

Implementation of the schedule and actions for local jurisdictions depends upon funding and other resources.

Habitat Treatment and Protection - Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. EDT has been modeled for productivity in the Cowlitz basin in The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans and has been used by Tacoma Power for the FERC re-licensing agreements for the upper basin productivity goals. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP), which documents barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis (LFA) - A WRIA 26 LFA was conducted by the Washington State Conservation Commission (May 2002). WRIA 26 was separated into seven sub-basins; Coweeman, Lower Cowlitz, Toutle, Mayfield/Tilton, Riffe Lake, Cispus, and Upper Cowlitz.

3.5 Ecological interactions.

(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program:* Out-migrant hatchery fish can be preyed upon through the entire migration corridor from the river sub-basin to the mainstem Columbia River and estuary. Northern pikeminnows and introduced spiny rays, as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons in the Columbia mainstem sloughs, can prey on steelhead smolts. Mammals that can take a heavy toll on migrating smolts and returning adults include: harbor seals, sea lions, river otters and orcas

(2) *Salmonid and non-salmonid fishes or species that could be negatively impacted by the program:* Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run Chinook salmon ESU (threatened); Snake River spring/summer-run Chinook salmon ESU (threatened); Lower Columbia River Chinook salmon ESU (threatened); Upper Columbia River spring-run Chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). Listed fish can be impacted through a complex web of short and long term processes and over multiple time periods which makes evaluation of this a net effect difficult. WDFW is unaware of studies directly evaluating adverse ecological effects to listed salmon. In addition the program may have unknown impacts on eulachon populations in the basin.

(3) *Salmonid and non-salmonid fishes or other species that could positively impact the program.* Multiple programs including fall and spring Chinook, coho and steelhead programs are released from the Cowlitz Hatchery and limited natural production of Chinook, coho, chum and steelhead occurs in this system along with non-salmonid fishes (sculpins, lampreys and sucker etc.).

(4) *Salmonid and non-salmonid fishes or species that could be positively impacted by the program.* Spring Chinook smolts can be preyed upon release thru the entire migration corridor from the river sub-basin to the mainstem Columbia River and estuary, and thus providing a food source for other populations. Northern pikeminnows and introduced spiny rays in the Columbia mainstem sloughs as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons can prey on chinook smolts. Mammals that benefit from migrating smolts and returning adults include:

harbor seals, sea lions, river otters and orcas. Hatchery fish provide an additional food source to natural predators that might otherwise consume listed fish and may overwhelm established predators providing a beneficial, protective effect to co-occurring wild fish. Hatchery releases can also behaviorally encourage mass emigration of multiple species through the watershed, reducing residency. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmonids have been found to elevate stream productivity through several pathways, including:

a) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998);
b) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and
c) Juvenile salmonids have been observed to feed directly on carcasses (Bilby et al. 1996).

4 SECTION 4. WATER SOURCE

4.1 Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Table 4.1.1: Water sources at Cowlitz Salmon Hatchery.

Water Source	Water Right	Available Water Flow	Avg Water Temp (°C)	Usage	Limitations
Well	G2-*08829C	2,060 gpm	6-9	Incubation/early rearing.	None
Well	G2-*8830C	2,860 gpm			
Cowlitz River (surface)	S2-*19889C	200 cfs	4-13	Hatchery supply	BKD, IHNV, C. Shasta

Source: Phinney 2006, WDOE Water Resources Explorer 2014, WDFW hatchery data.

Cowlitz Salmon Hatchery: The Cowlitz Salmon Hatchery is supplied from multiple sources. The majority of water is supplied from the Cowlitz River, with a maximum of 75,000 gallons per minute (gpm) available to the rearing ponds. An additional 15,000 gpm is available for the fish separator and ladder. The other sources are "C-wells" (1,000 gpm) and "PW–wells"(700 gpm). The wells are used between August and July, normally for egg incubation and early fry rearing. The temperature of water supplied to the Cowlitz Salmon Hatchery ranged from 4° to 13°C for river water, and from about 6° to 9°C for the groundwater (Harza 1997a in FERC 2001). An additional water right of 8 cfs was obtained for the BPA funded Stress Relief ponds (SR's) for utilization with the upper Cowlitz River Restoration Project. The stress relief ponds have an alarm at the head box.

The primary concern during incubation is *Saprolegniasis* (fungus), which requires daily formalin treatments at 1:600 for 15 minutes. Excessive gas in the incubation effluent is variable and may be associated with periodic increases in yolk coagulation in eggs and fry. Supersaturated nitrogen gas conditions during high water necessitate the use of the dinitrofication tower system. Water flow to fry is kept below 6 gpm to reduce or eliminate Bacterial Cold Water Disease (BCWD). A fish pathologist routinely checks for Infectious Hematopoeitic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD). All equipment in the rearing ponds is sanitized with a disinfectant solution after each use.

The water right permit for the Cowlitz Salmon Hatchery formalized through the Washington Department of Ecology, and is held by Tacoma Power (see **Table 4.1.1**).

Friends of the Cowlitz net pens: The Toledo Sand and Gravel Pond #5 is ten surface acres. Spring-water seeps into the pond at an unknown amount and rate. Water also seeps through the

existing dike road, which separates the pond from the river. Water temperatures reflect ambient temperatures occurring in the river, although thermal heating on warm days can elevate the temperatures in the net pens. Water temperatures during the rearing period are generally range from the low 40s°F to the low 50s°F upon release in March.

NPDES permit

The Cowlitz Salmon Hatchery operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE) (**Table 4.1.2**).

Discharges from the cleaning treatment system are monitored as follows:

- *Total Suspended Solids (TSS)* 1 to 2 times per month on composite effluent, maximum effluent and influent samples.
- *Settleable Solids (SS)* 1 to 2 times per week on effluent and influent samples.
- *In-hatchery Water Temperature* - daily maximum and minimum readings.

Table 4.1.2 Record of NPDES permit compliance at Cowlitz Salmon Hatchery.

Facility/ Permit #	Reports Submitted Y/N			Last Inspection Date	Violations Last 5 yrs	Corrective Actions Y/N	Meets Compliance Y/N
	Monthly	Qtrly	Annual				
CSH WAG13-1021	Y	Y	Y	3/6/2013	0	N	Y

Source: Ann West, WDFW Hatcheries Headquarters Database 2014.

The Toledo Sand and Gravel Pond #5 is segregated from the Cowlitz River; by a large net structure, there is no access to the pond by other fish. The facility operates within the limitations established in its National Pollution Discharge Elimination System (NPDES) permit and the production from this facility falls below the minimum production requirement for an NPDES permit.

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Intake and screen criteria are in compliance with state and federal guidelines (NOAA-NMFS 1995, 1996), but do not meet the current Anadromous Salmonid Passage Facility Design criteria (NOAA-NMFS 2011). The intake was evaluated by a WDFW engineer in November 2004.This assessment is based on structural components and the hydraulics of the intake by WDFW(November 16, 2004 Intake Assessment, Cowlitz Salmon Hatchery, Ray Berg, Lead Project Engineer). Velocity through intake screens, sweep velocity, mesh openings and juvenile bypass from screens do not meet criteria.

During the facilities renovation (completed in 2010), no major modification of the intakes at Cowlitz Salmon Hatchery was made by Tacoma Power because of the uncertainty over the potential breaching of the Barrier Dam. The water diversion and pump intakes at the salmon hatchery do not have adequate screens and may also pose a potential risk to naturally produced Chinook. Currently, the diversion and water intake structure for the Cowlitz Salmon Hatchery is adjacent to and immediately upstream of the Barrier Dam, and is not completely screened. There is some potential risk that some naturally produced fall Chinook juveniles could be taken should they enter this structure. Tacoma Power is investigating the intake to see if reasonable measures could result in improvements.

Friends of the Cowlitz net pens: As the Toledo Sand and Gravel Pond #5 is segregated from the Cowlitz River by a large net structure; there is no access to the pond by other fish.

5 SECTION 5. FACILITIES

5.1 Broodstock collection facilities (or methods).

The adult collection facility at the Cowlitz Salmon Hatchery consists of the Barrier Dam (constructed in 1969) across the river (length of 318 ft) and an associated fish ladder. The Barrier Dam, directs migrating adult fish to the fish ladder which leads to the salmon hatchery sorting facilities. There are right and left bank entrances to the fish ladder and an under spillway transport channel connecting the two ladder entrances. Fish move up the ladder to the sorting, transfer and holding facilities. Since construction, neither the transport channel nor the left bank entrance are in use because of design problems with the attraction flow. There is also an electrical field at Barrier Dam to aid in blocking fish. Adults can be sorted to holding ponds or also held in one of six circular tanks if they are to be transported. The adults can also be transferred to a number of other ponds including nine concrete ponds (80' x 15' x 6') via transfer tubes.

5.2 Fish transportation equipment (description of pen, tank truck, or container used).

Table 5.2.1: Transportation equipment available at Cowlitz Salmon Hatchery.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Average Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker Truck	1,500	Y	N	See below	Sodium chloride (Salt)	5,000 ppm (~0.5%)
Tanker Truck	750	Y	N	See below	Sodium chloride (Salt)	5,000 ppm (~0.5%)
Tanker Truck	100	Y	N	See below	Sodium chloride (Salt)	5,000 ppm (~0.5%)
Tanker Truck	250	Y	N	See below	Sodium chloride (Salt)	5,000 ppm (~0.5%)

Adult and juvenile fish are held in one of six 643 cubic feet circular tanks at the adult trap and separator before transport from the fish separation unit. Three 1,500 gallon tanker trucks are capable of hooking to the underside of the circular tanks and receiving fish through water displacement, which results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river.

In addition, several smaller tankers with air stones (one 750 gallon, one 1,000 gallon, one 1,500 gallon and several 250 gallon tanks) are utilized for moving fish around the facilities, as yearlings to the Toledo Sand and Gravel net pens, or as eyed eggs to the upper basin for artificial redd studies. Adult upriver hauls can take up to one hour; transport time to the Toledo Sand and Gravel pond is 25 minutes.

5.3 Broodstock holding and spawning facilities.

Table 5.3.1: Adult holding/spawning facilities available at Cowlitz Salmon Hatchery.

Ponds (number)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
6	Circular Separator Tanks	643	13.5	-	-	800
9	Concrete Ponds	7,200	80	15	6.0	2,500

Cowlitz Salmon Hatchery. Adults are separated to the following ponds for holding or transfer. The circular tanks are designed to hold up to 1,250 pounds of fish.

5.4 Incubation facilities.

Table 5.4.1: Incubation vessels available at Cowlitz Salmon Hatchery.

Type	Units (number)	Flow (gpm)	Volume (cu. ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Vertical stack units (16 trays/ Stack Unit)	160 (2,560 trays)	12 gpm on 4 units-		7,000	7,000

Free style deep isolation incubators	8 units	24 gpm all units		250,000 - 300,000[a]	
Vertical stack units (16 trays/Stack Unit) Recirculation Systems A&B	36 Stacks (288 trays)	3-5	-	10,000[b]	10,000[b]

There are 160 stacks of vertical incubators (Mari Source). Each stack consists of 16 trays which are divided into two half-stacks of eight trays with separate water supplies at 4 gpm (to hatching). Fry are incubated at 4 gpm (to ponding) and confined in vexar substrate to discourage excessive swimming and to provide the hatched salmon fry with a tactile environment prior to swim-up.

5.5 Rearing facilities.

Table 5.5.1: Rearing ponds available at Cowlitz Salmon Hatchery.

Ponds (No.)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
36	California Style Raceways	11,000	200	10	5.5	2,500	1.61	0.3
1	Concrete Backwash Kettle	8,000	200	5	8.0	50		
12	BPA Concrete Raceway	1,260	45	8	3.5	250	1.61	0.3

The twelve BPA stress relief ponds and two starter vessels were added to this facility in 1996 to assist the Upper Cowlitz River Reintroduction Program.

5.6 Acclimation/release facilities.

From CSH: Releases are from rearing ponds (see **HGMP section 5.5**) discharging into the Cowlitz River downstream of the Barrier Dam via volitional release pipe. Smolts are collected at the Cowlitz Falls Fish Collection Facility (CFFF) are trucked below the dams and released at RKm 79 from twelve stress-relief raceways located at the CSH. These raceways were constructed as part of the reintroduction and restoration effort and were designed to allow a time period for recovery (up to 48 hours), and volitional release. Smolts collected at the facility include naturally-produced smolts from natural-origin and hatchery adults that spawned in the upper watershed.

For upper river natural smolt releases: The upper Cowlitz Falls Dam presents a barrier which impedes or prevents downstream migration of smolts from the Upper Cowlitz. However, the dam includes a juvenile collection system with smolts taken to the Cowlitz Salmon Hatchery stress relief ponds until fish have acclimated for a day and then released (**See Table 2.2.3.2**).

Friends of the Cowlitz net pens: The Toledo Sand and Gravel pond is 10-acre old gravel pit, just off the Cowlitz River at RKm 44.5, off Branch Road near Hwy 505. The pond is fed by Cowlitz River water seeping through the dike that separates the pond from the river, and spring water (see **HGMP section 4.1**). The five 20'x20'x10' pens are covered with bird netting to reduce predation losses. Fish are transferred to the Toledo Sand and Gravel Pond net pens in late-fall.

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

Cowlitz Salmon Hatchery: Generally, no physical operational difficulties have been experienced. Pathogen outbreaks of *Ceratomyxa shasta* at the Cowlitz Salmon Hatchery and IHNV and *Ceratomyxa shasta* at Cowlitz Trout Hatchery have chronically caused some significant fish mortality in the past. Installation of an ozone treatment facility at the Cowlitz Trout Hatchery in 1991 has decreased mortality significantly.

Friends of the Cowlitz net pens: There have been no operational disasters at Toledo Sand and Gravel net pens.

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment

failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

During trapping season, tanker trucks are capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to any listed adult fish.

The hatchery has two back-up generators located in separate sheds and one backup generator in the basement for the recirculation systems and sump pumps installed during the remodel of the hatchery.The 1.5 KBW generator with upgraded switching equipment is capable of supplying power with suffiecient capacity to operate the two-200 hp pumps and two of the 600 hp pumps along with the residences in the event of a power outage. Tacoma Power has retained the 600 KW generator and switching equipment which would bring on one river pump in case the new generator should ever fail. Tacoma Power staff maintains the facility and with the Washington Department of Fish and Wildlife staff they test the emergency systems weekly. In event of system failure, there is an extensive alarm system capable of identifying problems in critical areas of the hatchery. On-station WDFW staff will respond to these alarms 24/7 with assistance from Tacoma Power staff if necessary.

A river water supply shunt valve was installed in 1999 to bypass the de-nitrification columns to provide water during the time the auxillary power is being used. During the remodel of the hatchery a larger river water supply valve was also installed off of the primary ring header supply line to provide more water down to the Stress Relief pond's if needed.

6 SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1 Source.

The hatchery program was developed using the local stock of spring Chinook salmon returning to the Cowlitz Salmon Hatchery.

6.2 Supporting information.

6.2.1 History.

The stock used for the hatchery production and upper river re-introduction program was integrated with the upper Cowlitz historic spring Chinook populations, including the Cispus and Tilton Rivers, under NOAA's proposed listing determination (June 14, 2004 - 69FR33102). Historically, spring Chinook salmon were found in the Cispus, Tilton, upper Cowlitz, and Toutle Rivers. The construction of Mayfield Dam in 1963 and Mossyrock Dam in 1967 eliminated the entire historical spawning habitat for spring Chinook salmon in the Cowlitz River. Natural spawning is now limited to a 12.8 km (7.7 miles) stretch in the mainstem Cowlitz River below the hatchery.

6.2.2 Annual size.

Approximately 1,337 mass-marked (adipose fin-clipped) adults are used for broodstock. An additional 200 adults are required to meet broodstock needs for the Cathlamet Channel (see **Cathlamet Channel Net Pen Spring Chinook HGMP**) and Friends of the Cowlitz net pen programs.

An additional 8,000 combined natural-origin and hatchery-origin adults are needed to continue the Upper Cowlitz reintroduction program (FHMP update 2011).

6.2.3 Past and proposed level of natural fish in broodstock.

Spring Chinook mass-marking began with 1996 brood year fish (1998 releases) thus the number of natural-origin fish used in the program prior to these returns are unknown. Currently only marked hatchery-origin adults are used for broodstock for this program; in the short term, naturally-produced adults will not be incorporated into the hatchery population.

6.2.4 Genetic or ecological differences.

Cowlitz Salmon Hatchery spring Chinook stock is believed to be a mixture of all historical populations of Cowlitz River spring Chinook populations. Between 1948 and 1993, 96% of all spring Chinook released in the Cowlitz River were Cowlitz hatchery stock. There have been no transfers from out of basin since 1993 (NOAA Technical Memorandum, 2006).

Stock mixing began when hatchery supplementation was initiated at the salmon hatchery in 1967 (WDF et. Al. 1993). Genetic analysis in the 1980s indicated that Cowlitz Salmon Hatchery spring Chinook were genetically similar to, but distinct from, Kalama Hatchery and Lewis River wild spring Chinook and significantly different from other lower Columbia River spring Chinook stocks (LCFRB Basin Plans 2010).

6.2.5 Reasons for choosing.

The hatchery stock represents one of the few remaining spring Chinook salmon populations in the LCR Chinook salmon ESU, and is vital to maintain the genetics of this stock for the planned reestablishment efforts in the upper Cowlitz River basin.

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

Natural origin fish are not used in the broodstock collection while upriver re-introduction programs are on-going. The program utilizes locally-adapted spring Chinook stock derived from adults returning to the Cowlitz Barrier Dam and avoids stock transfers from other facilities. These actions minimize the possibility of disease transfer into the basin and reduce the likelihood of straying.

Program broodstock is collected from marked adult volunteers of Cowlitz Hatchery returns to the Barrier Dam. Broodstock protocols and procedures of the program assure that sufficient numbers are collected to minimize founder effects of locally-adapted populations re-introduced into the mainstem Cowlitz and tributaries. Hatchery adults have been deemed appropriate for use along with unmarked fish to be transported and released in the upper Cowlitz basin/tributaries for natural spawning (FHMP update 2011).

7 SECTION 7. BROODSTOCK COLLECTION

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

Marked hatchery-origin adults returning to Cowlitz Salmon Hatchery.

7.2 Collection or sampling design.

Fish are collected throughout most of the run to meet specific fish management objectives and maintain the genetic integrity of this stock. Representative samples of the population are collected randomly throughout the run which is important to long-term fitness. Spring Chinook brood collection occurs from April through July.

A fish ladder at the base of the Barrier Dam leads to the trap and fish separator. Adults can be sorted/separated into appropriate ponds for holding until spawned. All adults not needed for broodstock are transported to the upper Cowlitz River above Cowlitz Falls Dam. Before transport, they are sorted by hand at the separator. Any fish above hatchery need (AHN) that are

detected as having an ad-clip/coded-wire tag are donated to food banks after the snouts are taken. All broodstock are inoculated with antibiotics for bacterial kidney disease and treated with formalin for fungus.

7.3 Identity.

Spring Chinook mass-marking of began in brood year 1996 (1998 releases). All hatchery-origin spring Chinook are marked with either an adipose fin-clip only (AD) or AD + coded-wire tag (CWT). The 55,000 spring Chinook transferred to the Friends of the Cowlitz (FOC) Toledo Sand and Gravel net pen site in the lower river are 100% AD-only. Cowlitz stock spring Chinook released from Cathlamet Channel net pens are also marked either with AD-only or AD+CWT (see **Cathlamet Channel Net Pen Spring Chinook HGMP**).

All adult fish are hand sorted at the Cowlitz Salmon Hatchery; only hatchery fish of the appropriate timing and number are retained for spawning. Unmarked natural spring Chinook are not integrated within the current broodstock. Prior to mass-marking (1998 releases), the proportion of natural-origin fish used in the broodstock was unknown.

7.4 Proposed number to be collected:

7.4.1 Program goal (assuming 1:1 sex ratio for adults):

Approximately 1,337 adults and up to 30 jacks.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Table 7.4.2.1: Total broodstock collected by sex, 2001-2013.

Year	Females	Males	Jacks
2001	534	353	51
2002	470	456	15
2003	401	388	17
2004	464	408	26
2005	488	466	28
2006	486	465	24
2007	494	293	22
2008	491	430	33
2009	346	310	26
2010	341	233	11
2011	604	241	16
2012	397	505	15
2013	741	380	21

Source: WDFW Hatcheries Headquarters Database 2014.

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

In the past, first time arrivals could be opercle punched and recycled downstream to Olequa Creek area in the lower river. Recaptures back to Cowlitz Salmon Hatchery were transported to the upper river. Currently, all available adults above hatchery need are transferred for release to the upper Cowlitz.

Table 7.5.1: Adult released upstream of Cowltiz Falls Dam by year, 1996 to present.

Return Year	Hatchery- Origin
1996	6
1997	51
1998	0
1999	268
2000	204
2001	128
2002*	1,763
2003*	8,589
2004*	11,471
2005	6,506
2006	3,135
2007	1,924
2008	820
2009	2,457
2010	8,281
2011	2,212
2012	4,530
2013	2,577

* 2002-2004 Unmarked spring Chinook were transitional to mass marking.

Source: John Serl, Cowlitz Falls Fish Facility Biologist 2014.

Returning hatchery adults provide significant escapement and nutrient needs to the upper system. Spring Chinook returning to the Cowlitz Salmon Hatchery separator are sorted; and fish designated for the upper watershed are placed in holding tanks. These are transported and released by Tacoma Power at the boat launch to Lake Scanewa at the LCPUD Day Use Park or Cispus River release site.

After an eleven year hiatus, adult spring Chinook salmon from the Cowlitz Salmon Hatchery were released above Cowlitz Falls Dam beginning in 1999 as part of the reintroduction program. (**Table 7.5.1**). Adaptive management plans have spring Chinook adults distributed in the upper Cowlitz at Packwood and the Cispus River to spread reintroductions due to temperature and fall back problems in Lake Scanewa. Under the updated FHMP (2011), up to 8,000 combined natural and hatchery-origin will be placed upstream (**Table 1.12.1**). No restrictions on placing hatchery fish upstream will occur until a trigger of 60% downstream fish passage survival is achieved with current survival under 20%.

7.6 Fish transportation and holding methods.

Fish collected at the Cowlitz Salmon Hatchery for broodstock are held in ponds that are 80’ x 15’ x 6’. From here they can be transferred from the ponds to the spawning room where they can be anesthetized, checked for ripeness, and spawned or returned to a holding pond via a return tube if not ripe.

Any adult fish are held prior to transport in one of six 643 cubic foot circular tanks at the adult trap and separator. These tanks are designed to hold up to 1,250 pounds of fish. The facility has three 1,500-gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through water displacement. This process results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river.

See also **HGMP section 5.2**.

7.7 Describe fish health maintenance and sanitation procedures applied.

All fish held for spawning are treated with formalin at 1:6,000 for fungus and parasite control. Spring Chinook adults are inoculated with Draxxin® for Bacterial Kidney Disease (BKD) at a rate of 0.5 cc/10 lbs of fish. A Fish Health Specialist tests for IHNV from 60 fish pool ovarian fluid samples; BKD is tested on all females with enzyme-linked immunosorbent assay (ELISA) on kidney/spleen samples.

The adult holding area is separated from all other hatchery operations. All equipment and personnel disinfection is done with iodine and Virkon® is used on the foot baths upon entering or exiting the area. Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning. Spawning implements are rinsed with an iodophor solution, and spawning area and implements are disinfected with iodophor solution at the end the spawning day.

7.8 Disposition of carcasses.

All spawned carcasses and mortalities are buried at a Tacoma Power upland site. Spawned carcasses are not, at this time, utilized for nutrient enhancement. WDFW follows Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), and state or tribal guidelines for broodstock fish health inspection, eggs or fish transfers, broodstock holding, and carcasses disposal.

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

The program has guidelines for acceptable contribution of hatchery fish to natural spawning. See **HGMP section 7.5.**

8 SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1 Selection method.

Fish are collected throughout most of the run which occurs from April through July. Spawners are selected randomly over the most of the run from fish arriving at the separator, representing the percentage of the total run that is collected during that particular sorting period. Ripe males and females available on spawning day are mated randomly.

8.2 Males.

Males are normally used once except when the male-to-female ratio is too low; males are then are live-spawned and returned to pond with a caudal fin clip for identification (occurs during the first and last spawnings), they are only used again at the end of the season if there are no males available to match the 1:1 ratio with the females.

Jacks (precocious males) are used for broodstock in proportion to their contribution to the adult run. Per WDFW Spawning Guidelines (2009) at a rate of a minimum of 2% of the total spawing population.

8.3 Fertilization.

Chinook are spawned at a 1:1 male:female spawning ratio, except when the male:female return ratio is too low (see **HGMP section 8.2**).

8.4 Cryopreserved gametes.

Cryopreserved gametes are not used.

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

Listed natural spring Chinook are not currently used for broodstock. Males and females are mated randomly from available broodstock. Hatchery staff disinfects hands and spawning implements in iodophor solution between individual spawnings.

After fertilization, the eggs are disinfected and water-hardened in an iodine solution for one hour, before being placed in the incubators. A Fish Heath Specialist takes 60 ovarian fluid samples to check for IHNV every season.

ELISAs are done on all females and, eggs are isolated according to ELISA values during picking. "Below-low" ELISA designations are retained for production. Various combinations of spring Chinook with low-, moderate- and high-ELISA values are culled if goals have neen met with "Below-low" eggs.

9 SECTION 9. INCUBATION AND REARING

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1 Incubation:

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

Table 9.1.1.1: Survival rates (%) from egg-take to ponding, Cowlitz River Spring Chinook.

Year	Egg-Take	% Survival	
		Green-to-Eyed Eggs	Eyed Egg-to-Ponding
2001	2,272,881	92.0	NA
2002	1,867,200	96.2	97.8
2003	1,747,100	95.8	97.4
2004	1,700,200	96.5	96.9
2005	1,739,800	94.1	95.9
2006	1,741,800	96.0	96.8
2007	1,835,600	96.0	96.7
2008	1,797,400	97.0	98.4
2009	1,792,700	94.9	96.0
2010	2,221,900	95.4	96.7
2011	3,283,300	95.7	97.4
2012	3,186,000	95.6	96.5
2013	3,595,344	97.4	97.8
Average	**2,213,940**	**95.6**	**97.0**

NA – Not available.
Source: WDFW Hatcheries Headquarters Database 2014 & CSH Annual Reports.

9.1.2 Cause for, and disposition of surplus egg takes.

When egg survival is higher than expected and/or surplus eggs are taken, resultant eggs will be transferredto the Upper Cowlitz sub-basin/tributaries for artificial redds or culled.

Prior to the 1993 brood spring Chinook, unfed fry from excess eggs were planted to the river through the hatchery wasteway. Zero-age plants through the hatchery wasteway to the Cowlitz River ended with the 1996 brood. Currently, all spring Chinook are utilized based upon program priorities: 1) Cowlitz Salmon Hatchery yearling production; 2) in-basin cooperative rearing programs (Toledo Sand and Gravel net pens) and 3)Upper Cowlitz River Restoration Project (Cowlitz Falls Dam smolt collection).

9.1.3 Loading densities applied during incubation.

Spring Chinook eggs are typically around 1,590 eggs/ lb. Standard loading per vertical tray at eyeing is 7,000 eggs/tray. Prior to this, the trays are loaded one female/ tray for ELISA separation. When results of tests are known, eyed-eggs with like-ELISA values are combined at 7,000 eggs/tray. Vertical incubators consist of 16 trays divided into two half stacks of 8 trays. Each half-stack has a separate water supply at 4 gpm (to hatching). Fry are incubated at 4 gpm (to ponding) and confined in Vexar® substrate to discourage excessive swimming. Water flow to fry below 6 gpm is known to reduce or eliminate Bacterial Cold Water Disease (BCWD) in the early life history of salmon in vertical incubators.

9.1.4 Incubation conditions.

All eggs were water hardened in a 100-ppm iodophor solution for 1 hour and hatched in vertical incubators with flows set at 4 gpm. After eyeing and picking, second picking of fry is down after hatch is completed and Vexar® substrate is placed in the trays with the hatched fry , which results in healthier, larger and more uniform fry development.

Typically, in a two-stack (8 trays) incubation unit with eggs, influent water to top tray has a dissolved oxygen (DO) content of 11 ppm while the effluent water at bottom tray has ~9 ppm at < 50°F. Influent total gas continues to be variable and sometimes unacceptably high depending upon well and other water sources. Total gas in influent water in the header trough has exceeded 113% and influent water is typically above 100% saturation as measured by Harza N.W. and the Cowlitz hatchery staff.

Water flow to fry is kept below 6 gpm to reduce or eliminate Bacterial Cold Water Disease (BCWD). A fish pathologist routinely checks for Infectious Hematopoeitic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD). All equipment in the rearing ponds is sanitized with a disinfectant solution after each use.

See also **Attachment 1** for virology sampling information.

9.1.5 Ponding.

Spring Chinook fry are ponded after swim-up when less than 1 mm of yolk is showing, at approximately 1,780 Temperature Units (TUs) and 1,200 fpp (36 mm fl). Fry are force ponded from the incubators to the raceways between mid- November and late-December.

9.1.6 Fish health maintenance and monitoring.

- *Saprolegnia*sis fungus is the primary concern during incubation, and requires daily treatments with formalin at 1:600 for 15 minutes.
- Water flow to fry is kept below 6 gpm to reduce or eliminate Bacterial Cold Water Disease (BCWD).

- Excessive gas in the incubation influent water is variable and appears to be associated with periodic increases in yolk coagulation in eggs and fry.
- A fish pathologist routinely checks for Infectious Hematopoeitic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD).
- All equipment in the rearing ponds is sanitized with a disinfectant solution after each use.

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

IHOT and WDFW species-specific fish health incubation guidelines are followed for water quality, flows, temperature, substrate and incubator capacities.

- Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equally.
- Incubation takes place in well water.
- Disinfection procedures are implemented during incubation to prevent pathogen transmission between stocks of fish on site.
- Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.
- Head-boxes are equipped with low-water level monitoring alarms.

9.2 Rearing:

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Table 9.2.1.1: Survival rates (%) from ponding to release, Cowlitz River Spring Chinook.

Year	Egg-Take	Fry-to-Smolt Survival (%)
2001	2,272,881	90.5
2002	1,867,200	93.9
2003	1,747,100	90.4
2004	1,700,200	86.5
2005	1,739,800	91.0
2006	1,741,800	88.2
2007	1,835,600	91.3
2008	1,797,400	88.5
2009	1,792,700	86.2
2010	2,221,900	88.3
2011	3,283,300	93.8
2012	3,186,000	96.0
2013	3,595,344	98.6
Average	**3,390,672**	**98.6**

Source: WDFW Annual Escapement Reports and Hatcheries Headquarters Database 2014 & Cowlitz Salmon Hatchery Annual reports.

9.2.2 Density and loading criteria (goals and actual levels).

Cowlitz Salmon Hatchery: Densities are < 0.5 lbs/ft^3, with density index at release of ~0.1. The goal is to not exceed a Density Index of 0.1 and maintain a Flow Index of 0.6.

Friends of the Cowlitz net pens: Following density-related studies conducted in the mid-1990s, all net pen projects are programmed to not exceed 0.50 lbs/cu.ft for Chinook.

9.2.3 Fish rearing conditions

Cowlitz Salmon Hatchery: IHOT standards are followed for: water quality, alarm systems, and predator control measures to provide the necessary security for the cultured stock, loading, and density. Rearing units are cleaned by vacuuming at least once a week, to remove settleable solids, unused feed and feces.

Total gas and corresponding DOs have been extensively monitored by Harza N.W., contractors with Tacoma Power. Carbon dioxide has not been measured in recent years.

Friends of the Cowlitz net pens: Fish are transferred to the net pen site in November. The net pens are net pens anchored in the Toledo Sand and Gravel pond #5. Water seeps through the dike road directly from the Cowlitz River and regulates the level of the pond; some spring seepage feeding the pond also reported. Water temperatures reflect ambient temperatures occurring in the river, although thermal heating on warm days can elevate the temperatures in the net pens. Water temperatures during the rearing period are generally range from the low 40s°F to the low 50s°F upon release in March.

The net pens are equipped with bird netting to minimize predation losses.

9.2.4 Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Table 9.2.4.1: Monthly fish growth information by length (mm), weight (fpp), condition factor and growth rate, collected during rearing.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate
December (At Swim-up)	35	1,100	0.00035	-----
January	39	700	0.00035	0.364
February	50	300	0.00035	0.571
March	60	175	0.00035	0.417
April	66	140	0.00035	0.300
May	73	98	0.00035	0.235
June	80	75	0.00035	0.280
July	90	54	0.00035	0.222
August	97	42	0.00035	0.167
September	103	35	0.00035	0.2857
October	116	25	0.00035	0.200
November	123	20	0.00035	0.450
December	130	17	0.00035	0.150
January	140	14	0.00035	0.177

9.2.5 Indicate monthly fish growth rate and energy reserve data (average program performance), if available.

See **HGMP section 9.2.4**.

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Cowlitz Salmon Hatchery: Spring Chinook are kept on a Bio-vita dry diet with double vitamins and are fed a Aquamycin feed for prophylactic treatments against BKD. Fish are given variety of diet formulations including starter, crumbles and pellets; the food brand used may vary, depending on cost and vendor contracts. Feeding frequencies varies depending on the fish size and water temperature. Late-ponded fish are fed as much as 2.5 - 3% B.W./day. As water cools in December prior to release, yearling groups are sometimes fed as little as 0.5% B.W./day. Overall feed conversions, including overwintering of yearling groups, averages around 0.85:1.

Friends of the Cowlitz (*FOC*) *net pens*: FOC volunteers feed fish regularly through the week and reports any problems to the staff at Cowlitz Salmon Hatchery. Yearlings are fed once a day, with an average 0.5% B.W./day. Overall feed conversions, including overwintering of yearling groups, averages around 0.85:1.0.

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

Fish Health Monitoring: Fish health is monitored on a daily basis by hatchery staff and at least monthly by a WDFW Fish Health Specialist. Hatchery personnel carry out treatments prescribed by the Fish Health Specialist. Procedures are consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006), *Fish Health Policy in the Columbia Basin* and *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Health Policy Chapter 5, IHOT 1995). A fish health specialist stationed at Cowlitz Complex inspects fish programs and checks both healthy and if present symptomatic fish. External signs such as lesions, discolorations, and fungal growths will lead to internal examinations of skin, gills and organs. Blood is checked for signs of anemia or other pathogens. Additional tests for virus or parasites are done if warranted (see **Attachment 1** for Virology Sampling reports).

A Fish Health Specialist stationed at Cowlitz Complex inspects fish before transfer to the Toledo Sand and Gravel net pens.

Disease Treatment: Renibacterium salmoninarum, the pathogen that causes BKD in salmonids, is passed from the adult via the egg stage to the juvenile fish. *R. salmoninarum* is also transmitted by the water-borne route among fish in the rearing ponds as well as from the hatchery water supply. Fry and sub-yearlings undergo ELISA segregation during rearing, as well as oral prophylactic treatments with Erythromycin. In the standard ponds, fry and fingerlings have been treated with florfenicol for Bacterial Cold Water Disease (BCWD) and Parasite-S for external parasites, fungus and *Trichodina* control in adults. Infectious Hematopoietic Necrosis Virus (IHNV) from adults can cause low-level chronic mortalities during the rearing period. Erythrocytic Inclusion Body syndrome has occurred in many years and predisposes fish to other diseases, such as BKD, fungal infections and BCWD, and frequently occurs concomitantly with these diseases. Formalin baths were also given after marking to prevent CWD and fungus from infecting the clipped area. Fish health and/or treatment reports are kept on file (see **Attachment 1** for Virology Sampling reports).

Sanitation: Mortalities are collected and disposed of at a landfill. All equipment (nets, tanks, boots, etc.) is disinfected with Virkon between different fish/egg lots. Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water. Tank trucks are disinfected between the hauling of adult and juvenile fish. Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

The migratory state of the release population is determined by time and size criteria as prescribed in the program. Gill ATPase is not used at this time, although organosomatic indexes were conducted by personnel from the WDF fish health section during late-1980s and early-1990s under BPA funding. ATPase work was conducted by Wally Zaugg, NMFS, in the early 1980s and reported in the Proceedings of the Northwest Fish Culture Conference for the fish released in the Cowlitz River.

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

The program attempts to better mimic the natural rearing environment by rearing under natural water temperature.

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

See **HGMP sections 5.8, 6.3, 7.9 and 9.1.7**.

10 SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1 Proposed fish release levels.

Table 10.1.1: Proposed release levels (maximum number) by life stage.

Age Class	Max. No.	Size (fpp)	Release Date	Location
Yearlings	500,000	16.0	November	Lower Cowlitz
	800,000	8.0	March/April	Lower Cowlitz
	496,899*	5.0	March/April	Lower Cowlitz

Source: WDFW Future Brood Document 2014. *Includes 55,000 yearlings provided to the Friends of the Cowlitz Toledo Net Pen project

Note: 5 fpp = 210 mm fork length (fl); 8 fpp = 180 mm fork length (fl); 16 fpp = 143 mm (fl).

10.2 Specific location(s) of proposed release(s).

Stream, river, or watercourse:	Cowlitz River (WRIA 26.0002)
Release point:	RKm 78.8, 44.5
Major watershed:	Cowlitz River
Basin or Region:	Cowlitz Basin, Lower Columbia River

10.3 Actual numbers and sizes of fish released by age class through the program.

Table 10.3.1: Number of fish released, size, CVs and release date, by age and year, Cowlitz Salmon Hatchery spring Chinook.

Release Year	Sub-Yearlings[a]				Yearlings			
	Number	Avg Size (fpp)	Mark Type	Date	Number	Avg Size (fpp)	CV	Date
2002	497,653	97.5	Unmk	4/22-23, 5/28-29	1,097,361	9.0	10.89	3/4, 4/18-30, 5/15-30
2003	943,456	96.6	Unmk	4/3, 8-9, 15 5/5, 8	975,259	9.5	11.02	3/3, 31, 4/1-4, 30
2004	289,092	101.8	Unmk	4/8-9, 5/4	951,682	9.7	9.64	3/22, 29, 5/1
2005	265,657	102.6	Unmk	3/29-30. 4/12	962,333	10.1	7.89	3/22, 4/4

2006	292,538	110.5	Vent	4/14, 24, 5/19	969,813	9.7	8.75	3/20, 27-28, 4/3
2007	264,939	78.2	Vent	4/10, 12 5/8, 10, 14	1,270,010	6.2	9.58	3/15, 4/2, 5/1
2008	296,018	70.9	Vent	4/11, 23-24 5/14-15, 6/3-4	903,214	5.7	8.45	4/1-4
2009	300,718	92.5	Vent	4/7, 30, 5/1	880,607	6.4	n/a	3/30-31
2010	319,553	96.4	Vent	4/7, 21	904,851	5.3	13.57	3/29-4/5
2011	299,576	135.2	Vent	3/22-24	732,347	5.1	11.41	3/25-4/1
2012				-----	829,096	5.3	10.58	3/26-4/2
2013	------	-----	-----	-----	974,697	5.1	8.54	3/29-4/3
	------	-----	-----	-----	571,282	15.6	8.75	11/1-4

Source: WDFW Hatcheries Headquarters Database 2014.

Note: 5.0 fpp = 235 mm fork length (fl); 6.3 fpp = 218 mm fl; 9.1 fpp = 193 mm fl; 15.0 fpp = 163 mm
70.4 fpp = 98 mm fl; 90.9 fpp = 90 mm; 135.1 fpp = 79 mm

[a] Upper Cowlitz, and Cispus Watershed (Upper Cispus and North Fork) sub-yearling plants were released with ventral fin clips from 2006 to 2011 (see **HGMP section 10.7**).

Table 10.3.2: Number of fish released, size, CVs and release date, by age and year, Friends of the Cowlitz net pen releases.

Release Year	Yearlings			
	Number	**Avg Size (fpp)**	**CV**	**Date**
2002	49,000	8.0	n/a	March 21
2003	50,000	10.8	n/a	March 25
2004	56,965	9.5	n/a	March 15
2005	55,800	8.1	n/a	March 21
2006	54,877	8.8	8.76	March 21
2007	53,256	6.2	7.69	March 20
2008	53,921	7.0	10.70	March 25
2009	53,423	6.7	n/a	March 25
2010	55,943	5.7	n/a	March 23
2011	45,022	4.6	n/a	March 15
2012	52,281	5.5	n/a	March 23

Source: WDFW Hatcheries Headquarters Database 2014.

Note: 5.0 fpp = 235 mm fork length (fl); 6.3 fpp = 218 mm fl; 9.1 fpp = 193 mm fl; 10.8 fpp = 182 mm

10.4 Actual dates of release and description of release protocols.

All releases are forced (see **HGMP section 5.5**). See **Table 10.3.1** and **Table 10.3.2** for actual release dates.

Cowlitz Salmon Hatchery: Historically, this program released sub-yearlings (30-80 fpp) in May/June. Currently there are November releases at 16 fpp, and spring releases (5 & 8 fpp) around the end ofMarch/April 1. The sub-yearling releases were eliminated after 1996, due to low observed survival rates.

Friends of the Cowlitz net pens: Fish are reared in the Toledo Sand and Gravel net pens from November to March.

10.5 Fish transportation procedures, if applicable.

Fish are transported from the Cowlitz Salmon Hatchery to the FOC net pens in an assortment of tanker trucks equipped with air stones and aerators (see **HGMP section 5.2**). Salt is added to the tanker at a rate of 0.5% of the volume by weight. Temperature is monitored in the tank and tempering is performed at the release/transfer site if the difference between the tank and the release water is greater than 7ºF. The two large trucks can transport up to 1,250 pounds of fish to

the upper Cowlitz watershed, and are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river. Transport time is approximately 30-60 minutes.

10.6 Acclimation procedures (methods applied and length of time).

Fish for on-station and upper Cowlitz River releases are reared their entire life on Cowlitz River water. See **HGMP section 10.5** for upper Cowlitz release procedures.

Friends of the Cowlitz net pen fish are reared approximately four months at the Toledo Sand and Gravel pond prior to release, from November to March. Water seeps through the dike road directly from the Cowlitz River and regulates the level of the pond; some spring seepage feeding the pond has also been reported. Spring Chinook releases appear to imprint to this lower river release site, as fishing guides congregate to this area heavily (pers. comm. Don Glaser).

10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Mass marking of spring Chinook began with 1996 brood year fish (1998 releases). All hatchery-origin spring Chinook are marked either with an adipose fin-clip only (AD) or AD + coded-wire tag (CWT). Currently, the November releases are 20% AD+CWT, and the yearling releases are about 15% AD+CWT.

Age Class	Max. No.	Size (fpp)	Release Date	Location
Yearlings	500,000	16.0	November	100K Ad + CWT, 400K Ad Only
	800,000	8.0	March/April	100 Ad + CWT , 700K Ad Only
	496,899*	5.0	March/April	100K Ad + CWT, 396,899 Ad Only

*55K spring Chinook transferred to the Friends of the Cowlitz (FOC) net pens are released 100% adipose fin-clipped only.

Sub-yearling plants (now discontinued, will continue to return through 2015) to the upper watershed were differentially marked with right- or left-ventral fin clips.

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Surplus are adjusted accordingly at the eyed-egg or unfed fry stages, to meet release target as specified in the Future Brood Document. The Future Brood Document (FBD) sets annual broodstock acquisition and egg-take goals. Only the set program number identified in the FBD is shipped to the Friends of the Cowlitz net pens. In the event of surplus egg-take, or when egg survival exceeds expectations, surplus eggs would be out-planted in artificial redds into the upper Cowlitz sub-basin/tributaries by UCR staff and cooperative enhancement groups or culled.

10.9 Fish health certification procedures applied pre-release.

Prior to transfer to the Friends of the Cowlitz net pen sites, or to release, the population health and condition is established by the Area Fish Health Specialist (FHS). This is commonly done one to three weeks prior to release. Staff will also contact the FHS whenever abnormal behavior or mortality is observed. The FHS examines affected fish, and recommends the appropriate treatment. Reporting and control of selected fish pathogens, and fish transfers into the sub-basin are done in accordance with the *Pacific Northwest Fish Health Protection Committee* (PNFHPC) and IHOT guidelines.

10.10 Emergency release procedures in response to flooding or water system failure.

There have been no instances of flooding or water system failure leading to early releases, however, the water systems at all of the Cowlitz River facilities are backed-up either by generator power or a secondary system. Cowlitz Hatchery also has the ability to flush release the fish into

the lower river, should it be necessary. Every attempt to keep the fish alive and healthy throughout the entire rearing-release cycle will be accommodated and all appropriate resource managers from the complex level to the federal level will be informed of the actions taken.

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

- Releases are consistent with past history indicating the time, size and conditional release of smolts for migration fitness and smoltification occurs within nearly the entire population, which reduces residence time in the river after release.
- Current size of release experiments in the lower river will be used to improve survival and result in additional information needed for life history traits.
- Fish are released at a time and size specified in an established juvenile production goal. Physiological measures, including allowable population fork length standard deviation (STD) and coefficient of variation (CV) maximums, will be used to monitor growth and population variations.
- The carrying capacity of the sub-basin was taken into account when determining the number of fish to be released.

11 SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1 Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

Table 11.1.1 is from the FHMP udate Appendix J - Monitoring and Evaluation Plan: Analytical Methods and Monitoring Activities of the FHMP, see attached Appendix J for additional information on specific monitoring activities.

Table 11.1.1: Monitoring activities that will provide the data (measure) that support the analysis for one or more populations in the project area.

Code	Name/Description	Analytical Methods Supported	Application (Populations)
MA-A	Carcass/Redd Surveys	AM-1, AM-2	LC: FCH, COH, STHD
MA-B	Juvenile Trapping	AM-1, AM-9, AM-10, AM-14	LC: FCH, COH, STHD, CUT
MA-C	Creel Survey	AM-4, AM-5	All Populations
MA-D	Catch Record Cards	AM-3, AM-4, AM-5, AM-11	LC: FCH, COH, STHD, SPC
MA-E	Hatchery Brood Bio-sampling	AM-6	LC: FCH, COH, STHD, SPC UC: COH, SPC
MA-F	In-hatchery Monitoring	AM-7	All hatchery programs
MA-G	Juveniles at Cowlitz Falls	AM-12	UC: COH, STHD, SPC, FCH
MA-H	Juveniles at Mayfield	AM-13	TIL: COH, STHD, SPC
MA-I	Adults at Separator	AM-11	UC: COH, STHD, SPC, FCH TIL: COH, STHD, SPC
MA-J	Weir Operation	AM-1b	LC: COH, STHD

Data Source: FHMP 2011 – Appendix J 2014.

WDFW Enhancement Co-ops follow a mandatory MOU; annual Volunteer Fish Production Project Records are tracked. WDFW use the results to determine and evaluate enhancement co-op contribution of smolts and adults to the system.

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

See HGMP section 11.1.

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

The Bonneville Power Administration (BPA) funds the evaluation of productivity of Chinook, late winter steelhead, coho and cutthroat trout in the upper Cowlitz River basins. Tacoma Power and WDFW fund the lower Cowlitz River monitoring programs.

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Monitoring activities follow scientific protocol in handling listed fish. Smolts handled for data collection such as condition factor, length and weight are anesthetized with MS-222 and placed in recovery tanks before hauling. At the salmon hatchery separation facility, adults can be transferred via water to water in the tanker truck fish to minimize stress.

12 SECTION 12. RESEARCH

12.1 Objective or purpose.

No research is directly associated with the program.

12.2 Cooperating and funding agencies.

Any research is conducted by WDFW and funded through Tacoma Power.

12.3 Principle investigator or project supervisor and staff.

Bryce Glaser (WDFW) and Mark LaRiviere (Tacoma Power)

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Not applicable.

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

Not applicable.

12.6 Dates or time period in which research activity occurs.

Not applicable.

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

Not applicable.

12.8 Expected type and effects of take and potential for injury or mortality.

Not applicable.

12.9 Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

Not applicable.

12.10 Alternative methods to achieve project objectives.

Not applicable.

12.11 List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Not applicable.

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

Not applicable.

13 SECTION 13. ATTACHMENTS AND CITATIONS

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Attachment 1: WDFW Virology Sampling 2006-2007 through 2012-2013: Cowlitz Hatchery Complex.

Source: WDFW Fish Health Lab data 2013 (John Kerwin)

Hatchery/ Collection site	Stock	Species	Date Sampled	Results	Comments	Life Stage	Sample number	NUMBER OF SAMPLES						CELL LINE	ID	FRZ DATE	INOC DATE
								OF	POOL	K/S	POOL	fry/visc/other	pools				
COWLITZ S	COWLITZ R	FCHIN	10/11/06	NEV		AD	1012-1/2	25	5	40	8						
COWLITZ S	COWLITZ R	FCHIN	10/18/06	NEV		AD	1019-7/8	35	7	20	4						
COWLITZ S	COWLITZ R	SPCHIN	09/05/06	**PARAMYXOVIRUS**	4+/9p OF & 4+/12p K/S	AD	0905-3/4	45	9	60	12			C	F&P	11/07/06	
COWLITZ S	COWLITZ R	SPCHIN	09/12/06	**IHNV**	1+/4p OF	AD	0912-14-15	20	4					E/C	DB	10/06/06	
COWLITZ S	COWLITZ R	SPCHIN	09/05/07	NEV		AD	0906-4/5	30	6	30	6						
COWLITZ S	COWLITZ R	SPCHIN	09/11/07	**PARAMYXOVIRUS**	1+/6p OF & 2+/6p K/S	AD	0912-12/13	30	6	30	6			C	F&P	11/01/07	
COWLITZ S	COWLITZ R	FCHIN	10/22/07	**PARAMYXOVIRUS**	1+/12p K/S	AD	1023-3/4	60	12	60	12			C	F&P	02/29/08	
COWLITZ S	COWLITZ R	SPCHIN	07/09/08	NEV	diag, F #1, M #2, $10^0 - 10^{-3}$, BP	IMM AD	0710-1			2	2						
COWLITZ S	COWLITZ R	SPCHIN	09/08/08	NEV	BP	JUV/07	0908-5			10	2						
COWLITZ S	COWLITZ R	SPCHIN	09/09/08	NEV		AD	0910-9/10	30	6	30	6						
COWLITZ S	COWLITZ R	SPCHIN	09/16/08	**IHNV**	1+/6p OF & K/S	AD	0917-1/2	30	6	30	6			E/C	DB	10/10/08	
COWLITZ R TRAP	COWLITZ R	SPCHIN	09/22/08	NEV	diag; 10^0, 10^{-1}; BP	SMOLT	0923-3			8	2						
COWLITZ T	COWLITZ R	SSTHD	10/15/08	NEV	diag, 10^0-10^{-1}	AD	1016-8			1	1						
COWLITZ S	COWLITZ R	FCHIN	10/21/08	NEV		AD	1021-17/18	53	11	48	10						
COWLITZ S	COWLITZ R	FCHIN	10/23/08	NEV		AD	1024-5/6	12	3	12	3						
COWLITZ S	COWLITZ R	SPCHIN	11/05/08	NEV		JUV/08	1106-3			10	2						
COWLITZ S	COWLITZ R	SPCHIN	09/09/09	**IHNV**	1+/12p OF	AD	0910-4/5	60	12	60	12			C	PCR	12/07/09	
COWLITZ S	COWLITZ R	SPCHIN	09/09/09	**IHNV**	1+/12p OF	AD	0910-4/5	60	12	60	12			C	PCR	12/07/09	
COWLITZ S	COWLITZ R	FCHIN	10/13/09	NEV		AD	1013-13/14	35	7	35	7						
COWLITZ S	COWLITZ R	FCHIN	10/13/09	NEV		AD	1013-13/14	35	7	35	7						
COWLITZ S	COWLITZ R	FCHIN	10/28/09	NEV		AD	1029-7/8	25	5	25	5						
COWLITZ S	COWLITZ R	FCHIN	10/28/09	NEV		AD	1029-7/8	25	5	25	5						
COWLITZ S	COWLITZ R	FCHIN	06/15/10	NEV	Moribund/mort when collected, Diag 10^0-10^{-3}	JUV/09	0616-1					15	3				
COWLITZ S	COWLITZ R	SPCHIN	09/07/11	**IHNV**	OF and K/S: 1+/12P	AD	0908-5/6	60	12	60	12				S/N	10/7/11	
COWLITZ S	COWLITZ R	FCHIN	10/18/11	NEV		AD	1019-1/2	60	12	60	12						
COWLITZ S	COWLITZ R	SPCHIN	09/17/12	**IHNV**	4+/12P	AD	0919-19/20	60	12	60	12			E/C	SN	11/16/12	9/11
COWLITZ S	COWLITZ R	FCHIN	10/31/12	NEV		AD	1031-6/7	60	12	60	12						10/4
COWLITZ S	COWLITZ R	SPCHIN	09/17/13	NEV		AD	0918-10/11	60	12	60	12						09/19/13
COWLITZ S	COWLITZ R	FCHIN	10/22/13	NEV		AD	1024-3/4	60	12	60	12						10/24/13

Note: for other salmon and steelhead data, see respective HGMPs.

14 SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

15 ADDENDUM A. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. (Anadromous salmonid effects are addressed in Section 2).

15.1 List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

The WDFW and the USFWS have a Cooperative Agreement pursuant to section 6(c) of the Endangered Species Act that covers the majority of the WDFW actions, including hatchery operations.

> "The department is authorized by the USFWS for certain activities that may result in the take of bull trout, including salmon/steelhead hatchery broodstocking, hatchery monitoring and evaluation activities and conservation activities such as adult traps, juvenile monitoring, spawning ground surveys..."

15.2 Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

Several USFWS listed and candidate species are found in Lewis County, however the hatchery operations and facilities for this program do not fall within the critical habitat for any of these species. As such there are no effects anticipated for these species.

Listed or candidate species:
"No effect" for the following species:

Bull trout (*Salvelinus confluentus*) – Threatened (Critical Habitat Designated)
Nelson's checker-mallow (*Sidalcea nelsoniana*) –Threatened
Marbled murrelet (*Brachyramphus marmoratus*) –Threatened (Critical Habitat Designated)
Columbian White-Tailed deer (*Odocoileus virginianus leucurus*) – Endangered
Gray Wolf (*Canis lupus*) –Threatened
Northern Spotted owl (*Strix occidentalis caurina*) –Threatened (Critical Habitat Designated)

Candidate Species
North American wolverine *(Gulo gulo luteus)* – contiguous U.S. DPS

15.3 Analyze effects.

Not applicable.

15.4 Actions taken to minimize potential effects.

Program steelhead are released fully smolted to foster rapid outmigration from the basin and to minimize predation and residualism risks.

15.5 References

Not applicable.

16 "Take" Tables

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chinook (*Oncorhynchus tshawytscha*) Steelhead *(Oncorhynchus mykiss*) Coho (*Oncorhynchus kisutch*) Chum (*Oncorhynchus keta*)	**ESU/Population:** Lower Columbia River Chinook Lower Columbia River Steelhead Lower Columbia River Coho Columbia River Chum	**Activity:** Cowlitz Spring Chinook program
Location of hatchery activity: Cowlitz Salmon Hatchery, Cowlitz River at RKm 78.8	**Dates of activity:** September-March h	**Hatchery program operator:** WDFW

Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass	TBD	TBD	TBD	TBD
Collect for transport	TBD	TBD	TBD	TBD
Capture, handle, and release	TBD	TBD	TBD	TBD
Capture, handle, tag/mark/tissue sample, and release	TBD	TBD	TBD	TBD
Removal (e.g. broodstock)	TBD	TBD	TBD	TBD
Intentional lethal take	TBD	TBD	TBD	TBD
Unintentional lethal take	TBD	TBD	TBD	TBD
Other Take (specify)	TBD	TBD	TBD	TBD

Take Tables to be submitted to NOAA-NMFS, in progress. Will contain monitoring activites.